

THE
STRUCTURE AND CAPACITY
OF
AUSTRALIAN
MANUFACTURING INDUSTRIES

COMMONWEALTH OF AUSTRALIA :
DIVISION OF INDUSTRIAL DEVELOPMENT
DEPARTMENT OF NATIONAL DEVELOPMENT

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COMMONWEALTH OF AUSTRALIA

**The
Structure and Capacity
of
Australian
Manufacturing Industries**

Prepared by

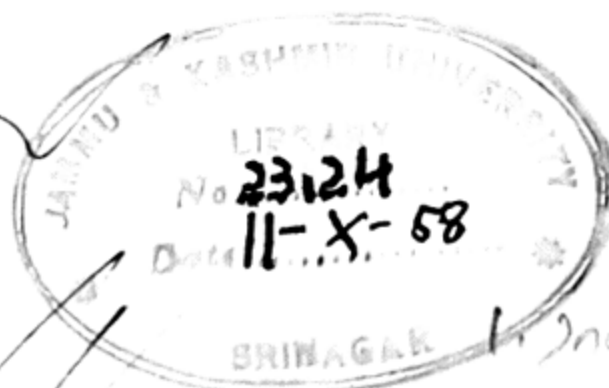
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Industries - Australia

Foreword

THE aim of this study is a consistent body of information on Australian secondary industry—a section of the economy which employs nearly one million persons, and about which there is little systematised information to supplement the basic statistical publications of the Bureau of Census and Statistics. It is important that we should know something of what is happening and has happened to our manufacturing industries in view of their importance in the economy. It is true that giant strides have occurred since before the 1939-45 War, but this progress is often misinterpreted and wrongly assessed. This is understandable when it is realised that very few people have the time or opportunity to study (and particularly to discuss with manufacturers) the thousands of products that are made in the 43,000 factories in Australia, representing at least 200 major and distinct industries. It is chiefly because of this complexity that the present study, although embracing some 500 pages, is no more than a general outline.

The balancing of material supplies with the productive needs of manufacturing industries and of the output of those industries with the requirements of the economy is a very complex matter largely determined by free economic forces. The diverse flow of resources into manufacturing industries and of the resultant output between various manufacturing plants, and then from manufacturing industry to the rest of the economy, probably is responsible for the greater part of economic activity. The study of this flow of resources in terms of output in relation to the volume of resources used, which requires identification of resources usage in all industries, has been carried to an advanced stage overseas. Much more of this type of research will need to be done in Australia before the working of the economy is adequately understood.

The study here presented contains incidental references to the processes used in industry, but does not consider the application of these processes or other aspects of technology. This would involve a consideration of the whole gamut of applied science and could only be done industry by industry. However, it is clearly evident that the efficient operation of industry is determined largely by its technological resources. So far as Australian industry is concerned, this problem merits considerably greater attention.

This study has been undertaken within seventeen broad industrial groups each in turn broken down into individual manufacturing activities. The treatment of each of the seventeen groups is in three parts. The first part gives for each separate activity within the group the number of firms engaged, the products made, the size of firms by employment and the degree of specialisation or integration, including other allied activities. The second part discusses the general operations within the group; reference is made, among other things, to estimates of demand and of capacity, statistics of production, imports and exports, market prospects, development programmes and the availability of materials and labour. The third part consists of statistical tables of employment, salaries and wages paid, value of production, value of materials used and value of output for the industries covered in Parts One and Two.

Four appendices have been included in the study, giving brief comment on the services available to manufacturers in Australia, the Customs Tariff, taxation, aids to industry, industrial expansion policy, statistical summaries, and explanatory

comment on the presentation of the study, its statistics and terminology. A detailed index of textual references to products, processes and manufacturing activities is provided.

The manufacturing industries of Australia are the prime concern of this study. However, there is some reference to certain materials produced outside secondary industries, but which are basic to manufacture. There is, therefore, some brief indication of Australian resources of major indigenous raw materials and minerals.

The classification and grouping of manufacturing activities adopted in the study have been prepared so as to accord as closely as possible with the actual combinations found and accepted throughout secondary industry. Perusal of the Table of Contents and particularly the Index should enable particular references to be readily found.

Preparation of the study has been greatly facilitated by the co-operation of industrialists, Commonwealth and State Government departments and officers of various institutes and associations. Valuable advice and information has been received from these sources, and much time was freely given in discussion. Without this co-operation the study could not have been completed in its present form. The statistical basis of the study is largely drawn from material collected by the Commonwealth Statistician.

The Division of Industrial Development will be pleased on application to discuss and, where possible, to amplify any matters relating to this study. The offices of the Division are located at: Wentworth House, 203 Collins Street, **Melbourne**; Phillip House, 119 Phillip Street, **Sydney**; National House, Ann Street, **Brisbane**; Masonic Chambers, 254 North Terrace, **Adelaide**; Commonwealth Bank Building, Forrest Place, **Perth**; Office of Department of National Development, **Canberra**; and Australia House, Strand, **London**.

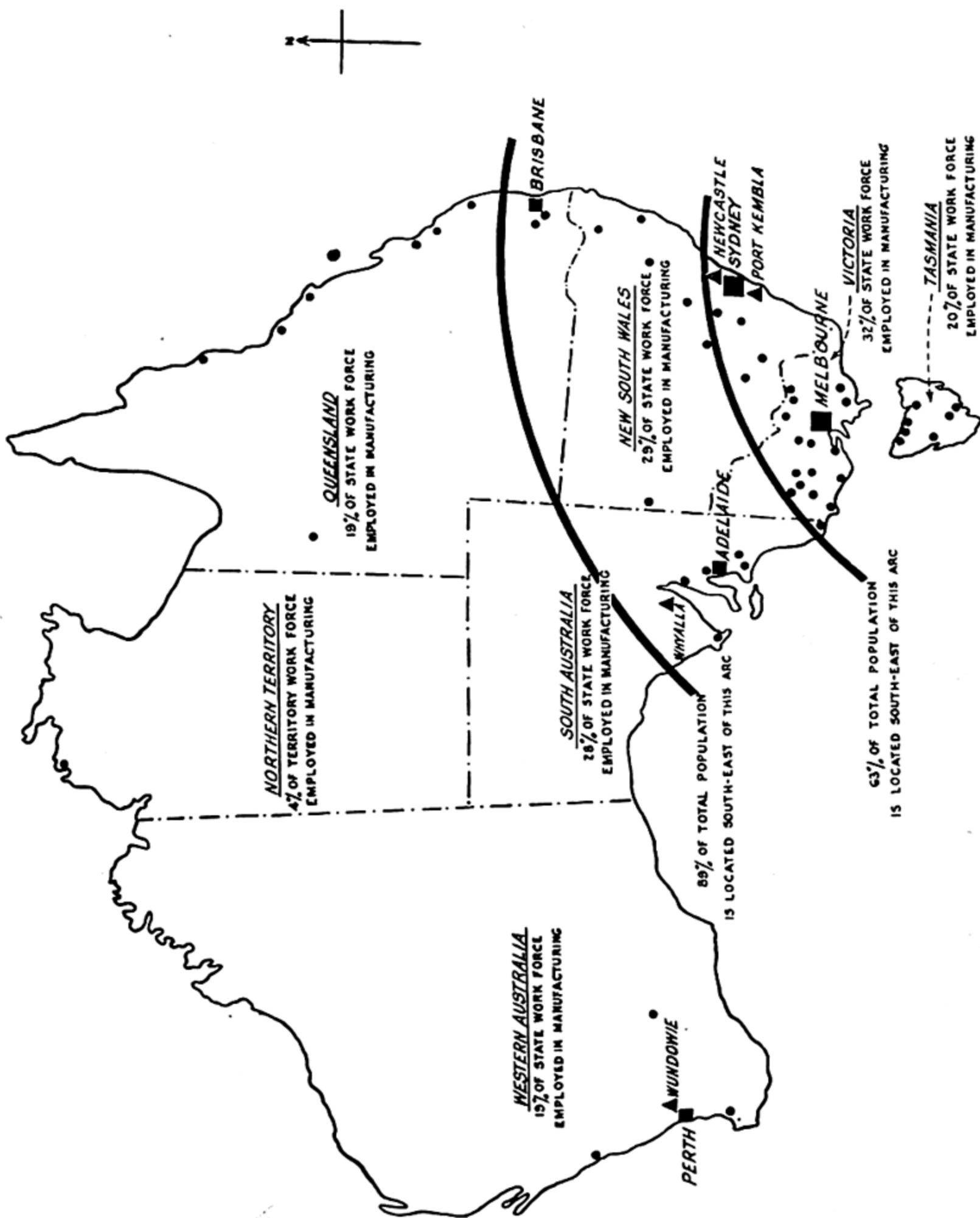
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- SMALLER SECONDARY INDUSTRIAL CENTRES



•AUSTRALIA

Chapter 1 :

FUELS

LUBRICANTS

LIGHT

POWER

Part One: Structure of Established Manufacturing Activities

THE fuel and power industries of Australia comprise: (a) The preparation of coal for the market and the production of derived fuels in the form of gas, briquettes and coke (b) the refining of petroleum or shale oil, including for convenience the preparation of lubricants and bitumen although these products are not consumed as fuels; (c) the generation of power, for public distribution, in thermal or hydro-electric stations. The listing below is intended to be reasonably indicative, but not necessarily fully inclusive.

PREPARATION OF COAL AND MANUFACTURE OF DERIVED FUELS

SCREENING: The preparation of coal at nearly all Australian collieries is confined to a token screening into two sizes known as "large" and "small". The separation is made at a screen size of $1\frac{1}{4}$ inches to $1\frac{1}{2}$ inches. These are the only sizes, other than run-of-mine, available to customers. Any further screening and crushing which may be desired, for instance at coke ovens and gasworks, are carried out by the consumer.

CLEANING: Each of the two integrated iron and steel works in New South Wales, those of The Broken Hill Proprietary Co. Ltd. at Newcastle and of its subsidiary company, Australian Iron and Steel Ltd. at Port Kembla, has a coal-washing plant. One has a capacity of 300 tons an hour and the other 250 tons an hour. In Queensland there are five small washing plants (largely obsolete) in operation, with a total capacity of about 125 tons an hour. In addition, one new coal-washing plant, with a capacity of about 300 tons an hour, has recently been completed and two others, each with a similar capacity, are nearing completion—two are located on the western fields and one on the northern fields of N.S.W.; all are Joint Coal Board plants.

HARD COKE: The hard coke industry comprises two distinct elements—the two major steel-works (which produce coke in their own ovens for use in the production of iron and steel) and seven independent producers which supply other consumers. The iron and steel works (see Chapter 9) are by far the largest producers of coke, their total capacity being about 1,925,000 tons a year compared with the independent producers which have a total capacity of about 207,000 tons a year. In July 1952, it was estimated that total employment in manufacture of hard coke was about 1,210, of which about 1,000 were employed in coke making at the two iron and steel works and about 210 at the seven independent coke works.

The Broken Hill Proprietary Co. Ltd., at its iron and steel works at Newcastle, N.S.W., has 161 regenerative by-product coke ovens, of the "Wilputte" and "Otto Wilputte" types, in three batches. Total capacity of these ovens is about 875,000 tons of coke a year. A further 68 ovens, with a total capacity of 245,000 tons a year, are to be installed; however, these may in time replace older ovens.

Australian Iron and Steel Ltd. (the principal subsidiary of The Broken Hill Proprietary Co. Ltd.) at its iron and steel works at Port Kembla, N.S.W., has 120 regenerative by-product coke ovens of the "Otto Wilputte" type in operation and a further 24 ovens nearly ready to start operating. Total capacity of these 144 ovens will be about 1,050,000 tons of coke a year.

Of the seven commercial coke producers, five are located in New South Wales and two are in Queensland.

The total capacity of the New South Wales producers is about 177,000 tons of coke a year. These producers are enumerated below. The Illawarra Coke Co. Ltd., Coalcliffe, has about 50 rectangular beehive coke ovens. The Federal Coke Co. Ltd., Wollongong, has 42 rectangular beehive coke ovens, of which 40 were operating in late 1951. The Mount Pleasant Coke Co. Pty. Ltd., Wollongong, has about 40 rectangular beehive coke ovens. The Corrimal Coal and Coke Co. Ltd., Corrimal, has 50 waste heat coke ovens. Purified Coal and Coke Pty. Ltd., Wallsend, has 70 beehive coke ovens, of which only 30 were operating in late 1951. The first four companies obtain their coal for coking from the southern New South Wales coalfields, and the last from the northern fields.

The two Queensland coke works have a total capacity of about 45,000 tons of coke a year. One of these works is very small. The Bowen State Coal Works, at Bowen, has about 45 rectangular beehive coke ovens, and obtains its coal supplies from the State Coal Mine at Collinsville. Tivoli Collieries Pty. Ltd., Haighmoore, have only four beehive ovens, and use coal from Ipswich.

SOFT COKE: 38 town-gas companies, located throughout Australia, provide fuel coke to local markets. Each produces on a large-enough scale to warrant notice as a soft-coke producer.

(See "Gas Production", this Part. The coke produced in Australian gasworks is too friable for use in cupolas, etc. It is used, instead, in water-gas and producer-gas plants and for domestic and industrial purposes not requiring a fuel of high mechanical strength.)

BRIQUETTES: No briquetting of black coal is practised in Australia. Some of the brown coal produced by the State Electricity Commission of Victoria is dried and briquetted for consumption mainly in one of the Commission's power stations and some by industry generally.

GAS PRODUCTION

In 1950-51 there were 100 gasworks in Australia producing town gas. Of these establishments 9 were owned and operated by governmental authorities, 31 by municipal bodies (local authority) and 60 by public or private companies. The number of persons employed in the production of town gas in 1949-50 was 3,815, of which 2,495 were engaged by 8 establishments each employing more than 100 persons. Of the remaining 92 establishments, 57 each employed 10 persons or less, 13 each from 11 to 20 persons, 17 each from 21 to 50 persons and 5 each from 51 to 100 persons.

TOWN GAS: There are 10 major organisations manufacturing gas supplies, of which 8 serve only metropolitan areas. These are, in Sydney, **The Australian Gaslight Co.** and **The North Shore Gas Co.**; in Brisbane, **The Brisbane Gas Co.** and **The South Brisbane Gas and Light Co. Ltd.**; in South Australia, the **South Australian Gas Co.** supplies Adelaide and Port Pirie; in Perth, the **Metropolitan Power Scheme & Gas Supply**, administered by the S.E.C.; and at Hobart, the **Hobart Gas Co. & Electric Light Works**. Until recently the **Brighton Gas Co. Ltd.** and the **Metropolitan Gas Co. Ltd.** were two of the three major organisations supplying Melbourne. Since 1st July, 1951, the control of these undertakings has been vested in the **Gas & Fuel Corporation of Victoria**—a State-Government instrumentality (which has the statutory power to acquire, compulsorily if necessary, gas undertakings in Victoria). Two other major organisations, the **Colonial Gas Association Ltd.** (which operates three large gasworks in suburbs of Melbourne) and the **Gas Supply Co. Ltd.**, both have their headquarters in Melbourne, and operate a number of establishments in suburban and rural areas in various States. Distribution of these undertakings is shown hereunder—

	Colonial Gas Association Ltd.	Gas Supply Co. Ltd.
	no.	no.
Victoria	9	9
New South Wales	7	2
Queensland	5	3
South Australia	1	—
Western Australia	1	—
Totals	23	14

In addition there are a number of municipal authorities and non-government enterprises engaged in the manufacture and supply of gas in various country towns throughout Australia.

BY-PRODUCT GAS: The coal gas made in by-product coke ovens in Newcastle and Port Kembla is used wholly within the iron and steel industry, including by-product recovery. Two other coke-works use waste-gas firing boilers.

PETROLEUM REFINING

There are five companies engaged in the manufacture of petroleum products. Four of these operate on crudes imported into the country. These are—

Name of Company	Ownership	Capacity of Refinery Barrels per stream day	Site of Refinery
Commonwealth Oil Refineries Ltd.	Anglo-Iranian Oil Co. Ltd., London, U.K. (a)	3,000	Laverton, Vic.
Shell Company of Australia Ltd.	Shell Petroleum Co. Ltd., London, U.K.	10,000	Clyde, N.S.W.
Bitumen and Oil Refineries (Aust.) Ltd.	60% Public in Australia 40% California-Texas Oil Co., U.S.A.	5,500	Botany, N.S.W.
Vacuum Oil Co. Pty. Ltd.	Standard Vacuum Oil Co., New York, U.S.A.	1,600	Altona, Vic.

(a) A Commonwealth Government holding of 50 per cent. in C.O.R. Ltd., held since establishment of the company in 1920, was sold to Anglo-Iranian Oil Co. Ltd. in October, 1952.

All four refineries are straight distillation units, i.e., they produce petroleum products in the proportions and in the form in which they exist in the crude oil charged. The fifth company, **National Oil Pty. Ltd.**, is owned by the Commonwealth Government, and operated at Glen Davis,

FUELS, LUBRICANTS, LIGHT, POWER

New South Wales. It refined crude shale oil into finished products; the shale oil being produced by the carbonisation of indigenous oil shale. The refinery had a capacity of 1,800 barrels per stream day and comprises the only cracking plant at present in Australia. The Commonwealth Government has announced its intention to withdraw financial support from the company and has appointed a Receiver to dispose of the assets. Tenders have been called for the purchase of the plant, which has been closed down.

Standard products of Australian refining companies, but not necessarily of each of them, are: Motor spirit; kerosene, automotive industrial and marine diesel oils; fuel oil; bitumen; lubricating oils and greases. Specialty products are: Liquefied petroleum gas; solvents; oil-based insecticides; emulsified and cut-back bitumens.

LUBRICANTS: This group comprises 20 manufacturers, including the four refining companies. Some of the manufacturers are small companies. Special products, such as insecticides (oil-based), are made by 11 manufacturers, and there are four reclaimers of oil.

EMULSIFIED BITUMENS AND ASPHALTS: There are twelve manufacturers in this group, including the petroleum refiners or associate companies.

BITUMINISED PRODUCTS

Bituminised Paper-Felt (for flooring, roofing, anti-drumming, pipe wrapping, etc.).

Bituminised Linings and Wrappings (of paper and/or paperboard, and of paper reinforced with jute fibre, sisal fibre, jute hessian, or aluminium foil).

Bituminised Paints

Bituminised Dampcourses, Cements and Mastics

About 40 manufacturers, of which about 7 of the largest make all or most of the products shown at the left, including the flooring and roofing felts. Bituminising of paper-felt (made in Australia only by Australian Paper Manufacturers Ltd.—see Chapter 4, "Pulp, Paper, Paperboard"), and of paper, fibres and hessian is carried on in Australia only by manufacturers wholly or mainly engaged in the bituminised-products activity; but bituminised paints, dampcourses, cements and mastics are also made by manufacturers whose principal activity is not that of bituminised products. — Bituminised paper felt for anti-drumming felt is made by two manufacturers

only, and one manufacturer of bituminised paper felt also bituminises asbestos felt for high-grade roofing and flooring felt. Pipe-wrapping felt is usually bituminised by the pipe manufacturers. (Felt-based linoleum is not made in Australia.) — A wide range of bituminised paper and/or paperboard products is made collectively by about 14 manufacturers. — About 12 manufacturers in the activity make bituminised paints, which are also made by a few paint manufacturers. — Bituminised dampcourses (including lead or copper strip prepared by coating, by two companies), and cements and mastics with a bitumen base, are made by about 12 manufacturers in the bituminised-products activity and by several others mainly engaged in other activities.

"Asphalt" Floor-tiles (asbestos-based, bituminised in the darker colours): Two manufacturers only. One is the Colonial Sugar Refining Co. Ltd., the leading sugar refiner and molasses by-products manufacturer in Australia, also engaged in making a wide range of building materials (plaster of Paris, gypsum wallboard, softboard (from bagasse), hardboard, asbestos-cement sheets and mouldings) and various chemicals; in its manufacture of floor-tiles the company is associated with Johns-Manville Corporation, U.S.A. The other manufacturer is a subsidiary company of Dunlop Australia Ltd., the leading manufacturer of rubber products in Australia; the subsidiary company is wholly engaged in the activity and is a similar venture to that operated by Dunlop Rubber Co. Ltd., U.K., an associate company of Dunlop Australia Ltd.

Bituminised Trim Board (used as "foundation" panel in motor-vehicle body construction, and for waterproof boxes and containers): One manufacturer only, a paperboard mill making thick board and footwear stiffener boards from wastepapers (see also Chapter 4, "Pulp, Paper, Paperboard"). The trim board is waterproofed by a bitumen compound, which is incorporated into the product in the course of preparing the paper fibres for manufacture into trim board.

Lined Pipes: Australian Iron and Steel Ltd., Newcastle, New South Wales, the principal Australian manufacturer of cast-iron pipes, lines a large proportion of its output with bitumen, and is the only major manufacturer of bitumen-lined pipes in Australia. There are about 10 smaller producers of cast-iron pipes, some of which, on request, will line the pipes with bitumen.

ELECTRIC POWER GENERATION

There is in each State a central State authority constituted to undertake the major role in the generation and distribution of electric power. In most States the major supply systems are interconnected to facilitate the interchange of power from appropriately located power stations. These systems vary in magnitude in accordance with the size of the State and the requirements of consumers. In remote areas, where supply from the major systems is not practicable, isolated power stations exist to meet the needs of these areas. Some of these smaller isolated systems are operated by local authorities or private organisations, and in general are designed to supply the power requirements of the particular town. In 1950-51 electric power for sale was generated in 354 establishments, compared with 358 in 1949-50. Of the 358

establishments, 36 were government, 169 municipal (local authority), and 153 otherwise owned; 285 each employed up to 10 persons, 26 each from 11 to 20 persons, 20 each from 21 to 50 persons, 10 each from 51 to 100 persons, and 17 each more than 100 persons. The latter 17 establishments collectively employed 6,805 persons out of an industry total of 9,599 persons; the 51-100 group employed 778 persons; the more-than-20 group employed 8,229 persons, and the not-more-than-20 group 1,370 persons. The major power authorities are outlined below.

NEW SOUTH WALES: The Electricity Commission of N.S.W. was constituted, pursuant to a statute passed in 1950, to assume responsibility for the generation and, with certain reservations, the distribution of electricity in N.S.W. It has power to take over or acquire existing electricity undertakings. The generation of electricity at present is shared between the State Government and local-government bodies and distribution is almost exclusively carried out by local-government agencies. A series of interconnected systems serves almost the whole of the coastal area, with the exception of a small section adjacent to the Queensland border and that part of the "South Coast" below Ulladulla. West and south-west of Sydney the system covers large areas extending inland as far as Dubbo and the Murrumbidgee Irrigation Area.

VICTORIA: The Electricity Commission of Victoria, a State Government authority, has power to co-ordinate and unify all electrical undertakings in Victoria. It engages in coal-winning operations and generates and distributes electricity through the State-wide system. The Melbourne City Council owns and operates, at West Melbourne, a large power-house which is linked to the State Electricity Commission's system and produces power to suit the demands of that system. Smaller local power stations mainly controlled by municipal authorities exist in most of the larger towns. Practically the whole of the Melbourne suburban railway system is operated under electric traction with energy supplied by a steam-power station operated by the State Electricity Commission. Electric power for Melbourne's tramway system is supplied by the State Electricity Commission and the Melbourne City Council, and converted to traction power by the Tramways Board. The State Electricity Commission supplies power to the tramway systems at Ballarat, Bendigo and Geelong, and also operates those systems.

QUEENSLAND: The generation and distribution of electric power is carried out by a number of independent bodies subject to the control and supervision of the State Electricity Commission. Two authorities with interconnected systems supply the greater Brisbane area—the Brisbane City Council and the City Electric Light Co. Ltd. A large portion of the northern coast and adjacent areas are divided into regions for electricity supply with the object of eliminating small local generating stations and supplying electricity in each region from a central source. Five Regional Electricity Boards have so far been constituted, two of which were subsequently amalgamated into one making four operative Boards.

SOUTH AUSTRALIA: The Electricity Trust of South Australia took over the supply of electricity to Adelaide and surrounding areas in 1946 and is extending its network to other parts of the State, absorbing local undertakings in the process.

WESTERN AUSTRALIA: The State Electricity Commission of Western Australia, established in 1945, generates and distributes electricity in Perth and the south-western area and controls local undertakings operating through the State.

TASMANIA: The major power stations in Tasmania are based entirely on hydro-electric power. Generation and distribution is almost entirely in the hands of the Hydro-Electric Commission of Tasmania, the transmission lines of which extend to all the settled parts of the State. The only private generating authority is the Mount Lyell Mining and Railway Co. Ltd., which operates a hydro-electric station linked to the Commission's west-coast transmission system.

COMMONWEALTH GOVERNMENT: The Commonwealth Government operates electricity supply undertakings at Canberra, Australian Capital Territory; and at Darwin, Katherine, Tennants Creek and Alice Springs in the Northern Territory. These undertakings are under the direction of the Department of Works and Housing. The Government has set up the Snowy Mountains Hydro-Electric Authority to undertake construction work and generation of electricity from the Snowy and other rivers in the area which lies across the far-eastern portion of the border between New South Wales and Victoria.

Part Two: Outline of Capacity of Manufacturing Activities

COAL AND DERIVED FUELS

COAL PRODUCTION

Australia possesses within her borders a wide range of coals from semi-anthracite of 12-15 per cent. volatile content on the dry ash-free basis to immature brown coal containing about 66 per cent. of moisture in situ. Coking coals are found in two States only—New South Wales and Queensland. (Collie coal, Western Australia, is believed to be suitable for the production of iron by the newly-developed low-shaft furnace process.) Because of the accessibility and extent of the main coalfields of New South Wales, that State developed a substantial steel industry and a large export trade in coal.

For many years, coal consumption in Australia increased at a greater rate than production. Overseas exports dwindled to less than 100,000 tons a year. Until early 1952, deliveries of New South Wales coal to the southern States were well below requirements for purposes to which local coals can-

not, at present, be applied. Many plants have, of necessity, been adapted to inferior local fuels. Other coal was imported from abroad and fuel-oil is being used in greater quantities.

The coal reserves of Australia were estimated by the Standards Association of Australia in 1947 as follows—

RESERVES:	Black Coal (bituminous and sub-bituminous)	Brown Coal
	mill. tons	mill. tons
New South Wales	11,718	—
Queensland	1,793	—
Western Australia	1,521	—
Victoria	16	37,163
South Australia	390	226
Tasmania	244	—
Total	15,682	37,389

The production and usage of Australian black coal in 1950 was as follows—

PRODUCTION AND USAGE, BLACK COAL:	Bituminous '000 tons	Sub-Bitu- minous '000 tons	Total '000 tons	Usage of N.S.W. Coal '000 tons	Total Usage Australian Coal '000 tons
New South Wales	12,798	—	12,798	10,630	10,630
Queensland	2,161	165	2,326	17	2,343
Western Australia	—	817	817	90	907
South Australia	—	259	259	768	1,027
Tasmania	211	—	211	51	262
Victoria	137	—	137	1,167	1,304
Totals	15,307	1,241	16,548	12,723	16,473

Open-cuts contributed 1,602,000 tons of black coal in New South Wales, 460,000 tons in Queensland and 258,000 tons in Western Australia. South Australia's output of 259,000 tons came wholly from an open cut. All other black-coal production was from deep mines. Black-coal production for 1950-51 was 16,410,000 tons and in 1951 17,610,000 tons. N.S.W. production in 1951-52 was 14,626,000 tons. Total Australian production in 1951-52 was 19,178,000 tons. The dependence of Victoria and South Australia on New South Wales coal is clearly evident.

The consumption of black coal in Australia by main uses during 1950 was about as follows —

CONSUMPTION, BLACK COAL:	1950 tons
Gas industry	2,000,000
Iron and Steel—	
Coking	2,170,000
Other purposes	500,000
Electrical power	2,670,000
Factories	4,316,000
Railways	3,600,000
Bunkers, etc.	3,367,000
Total	978,000
	16,931,000

The difference between local production and consumption is accounted for by net importations and changes in stocks. About 490,000 tons of coal were imported in 1949-50, mainly into Victoria and South Australia. It is estimated that at least another three million tons of New South Wales coal would have been consumed in 1950 if it had been available.

Substantial rises are expected in the demand for New South Wales coal in the long term.

It is planned to increase the output of black coal in New South Wales to about 18 million tons by 1954. The plans provide for the development of new underground mines, and for the extension of open-cut mining in that State. It is expected that open-cut production will be increased from the present level of 1.6 million tons annually to about 5 million tons.

Planned expansion of the black-coal industry in other States should raise their output by about two million tons a year by 1954. Of that quantity, about half a million tons will be contributed jointly by the Bowen, Blair Athol and Callide fields in Queensland. Another half million tons will be won at Leigh Creek, South Australia, and a somewhat similar expansion is expected on the Collie field in Western Australia. The target of Australian black-coal production in 1954 is 24 million tons.

With a marked increase in production in New South Wales (in some months output has exceeded an annual rate of 17 million tons) and also a relatively sharp increase in other States, coal supply overall is adequate to a demand which has not increased as earlier anticipated. Transport is a problem in distribution, and stocks are accumulating in New South Wales. Gas coal, which is still in short supply, may be available in ample quantities in 1953; meanwhile, some gas coal is being imported.

All coal produced in New South Wales is distributed by the Joint Coal Board, an authority established, in collaboration, by the Commonwealth Government and the New South Wales Government, and charged with the responsibility of seeing that adequate supplies of coal are produced in New South Wales, that coal deposits are conserved and used to the best advantage, that coal produced in New South Wales is distributed throughout Australia in the best interests of the public, and that the welfare of workers in the industry is promoted.

The production of brown coal is confined to Victoria and the principal operating authority is the State Electricity Commission. The coal face at the Commission's main open cut at Yallourn is 180-200 feet thick, beneath an overburden between 30 and 50 feet in thickness. The Commission is developing its third open cut at Morwell, a few miles from Yallourn. The average thicknesses of the coal and overburden in the new face will be about 380 and 43 feet respectively.

Private firms are operating on a smaller scale in Victorian brown coal deposits not under the control of the Commission. At Bacchus Marsh, which is only 30 miles from Melbourne, and at Wensley Bray, near Geelong, there is already considerable activity in winning open-cut coal to supply "run of crusher" and "graded" coal to industry for use as fuel. One company operates an open cut for the coal needs of an associated company engaged in paper and paperboard manufacture.

Production of brown coal by all operators in Victoria in 1951-52 was 8.1 million tons (in-

cluding nearly 1,000,000 tons from private operators). If present plans for increased production are fulfilled, the output of brown coal in 1956 will be about 15 million tons, but finance is a problem.

Screening and Cleaning

In recent years, collieries in Australia as in other countries have become more and more mechanised. Opportunities for discarding stone bands and dirty coal in the pit have, therefore, become fewer. The shortage of fuel, moreover, has resulted in the mining of coal which had previously been neglected as too dirty for immediate use. Increased production at open cuts has further raised the average ash content of coal supplied to consumers.

Because of the increasing demand for coal, it has been necessary to go further afield for supplies. For this and other reasons, there has been an increase in the transport required, particularly by rail, to bring coal from the source to the market. The rising ash content of the coal increases the cost of transport and reduces the effectiveness of the already inadequate transport facilities available. Moreover, the efficiency of utilisation of coal is often adversely affected by a high ash content. For these reasons, greater attention to the cleaning of coal is much to be desired in Australia. Three Joint Coal Board coal-washing plants are being installed on the coalfields of New South Wales, two in the western district at Lidsdale (recently completed) and Ben Bullen and one near Liddell on the northern field. Each will have a capacity of 300 tons an hour. The installation of further coal-washing plants is being considered.

COKING

Metallurgical Coke

Before the 1939-45 War, metallurgical coke was produced in quantities sufficient for the purposes of the consuming industries. Largely owing to coal shortages since the war, however, production of metallurgical coke has been insufficient until recently to meet the demand.

The two major iron and steel works in Australia own and operate their own coal mines and coke ovens. The production of coke at these plants is considered in this study as being within the activities of the steel industry (see Chapter 9). One ton of metallurgical coke is needed for each ton of pig iron to be produced, and is obtained from about 1½ tons of coking coal. The demand for coke by the iron and steel industry is dependent on the capacity to produce iron and steel, and planned expansion of the one demands an equivalent expansion of the other. In 1950, the industry would have needed 3,300,000 tons of coal for capacity production (including about 600,000 tons of coal for purposes other than coking). Deliveries totalled only 2,700,000 tons and there was a deficiency of 600,000 tons.

The iron and steel works' capacity for the production of coke in 1950-51 was about

1,676,000 tons a year, and an increase of 234,000 tons is expected in 1952. Capacity will be further expanded as required. In 1950 the iron and steel works produced only about 1,250,000 tons of coke, mainly because of the coal shortage, and in 1951 about 1,348,000 tons. Coal supplies are now adequate.

For iron foundries, other than those of the two steel companies and for non-ferrous smelting industries, metallurgical coke is produced in beehive ovens in New South Wales and Queensland. By-product coke from the iron and steel works is supplied to several customers outside the steel industry. The capacity of beehive ovens in New South Wales and Queensland is about 220,000 tons a year. Because of the coal shortage output in the year 1949-50 was only 145,000 tons. Improved allocations of coal lifted production to about 175,000 tons, or 83 per cent. of capacity, in the year 1950-51. In the following quarter, July to September, 1951, production was maintained at a level of 87 per cent. of capacity. The following table shows the consumption in 1949-50 and 1950-51 by industry and the estimated demand of these industries in 1951-52 and 1955 for metallurgical coke—

	Consumption		Estimated Minimum Demand	
	1949-50	1950-51	1951-52	1955
	tons	tons	tons	tons
Ferrous foundries	71,000	97,000	95,000	120,000
Non-ferrous smelting and refining	73,000	82,000	95,000	175,000
Miscellaneous (including heavy chemicals)	15,500	22,500	21,000	35,000
Totals	159,500 (a)	201,500 (a)	211,000 (b)	330,000 (b)

- (a) Imports and coke released by the iron and steel works now supplement supplies from commercial producers. Imports for metallurgical purposes amounted to 4,270 tons in 1949-50 and 655 tons in 1950-51. The steel works supplied about 12,000 tons in each year.
- (b) These estimates do not include the fluctuating requirement of up to 30,000 tons of hard coke used to replace soft coke when this is not available in adequate quantity. The 1955 estimate may be reduced to about 250,000 tons if several major expansion plans do not eventuate, as is possible.

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It is improbable that the New South Wales producers could achieve an output exceeding 90 per cent. of capacity over a yearly period, even if total coal supplies were adequate. This level of production would make available about 160,000 tons a year from New South Wales.

Queensland production is now about 45,000 tons a year, which is about capacity level under present conditions. Production in 1951-52 was about 200,000 tons. The balance of requirements would be covered by allocations from the iron and steel works. In the long run, the conditions of shortage operating during 1951, when supplies were about 45,000 tons a year less than demand, are likely to recur. By 1955, moreover, demand will have risen to a minimum of 330,000 tons; the figure may be as high as 400,000 tons. This is respectively about 110,000 tons and 180,000 tons in excess of present installed plant capacity. The only known plans for expansion will only raise capacity to about 230,000 tons.

Of the benzol produced at the iron and steel works, most is used in the chemical industry

as a solvent or raw material. About one million gallons annually are blended into motor fuels. Toluene is also produced at the steel works in nitration grades and of solvent quality. The naphthalene produced there is mainly used in the manufacture of phthalic anhydride for plasticisers and synthetic resins. The annual capacity for sulphate of ammonia production in by-product plants and including those of the gas industry is 30,000 tons. However, production in 1950-51 reached only 18,000 tons.

Soft Coke

The coke produced in Australian gasworks is too friable for use in metallurgical processes, and the coke not required for water-gas or producer-gas production at gasworks is sold. Production of soft coke in 1949-50 was about 1,100,000 tons, of which about 625,000 tons were available for sale. This coke was sold mainly for use by industry, institutions and householders. About 75,000 tons of coke breeze were also produced as a by-product, but there is little market for this in Australia.

BRIQUETTING

The manufacture of briquettes from Victorian brown coal was commenced in 1924, using the technique developed in Germany. Production of briquettes at the Yallourn briquette factory in 1950-51 was 511,400 tons; in 1948-49, 588,600 tons. The annual output of coal at the Yallourn and Yallourn North open cuts is now nearly 7,000,000 tons a year. In 1950-51, 4,346,000 tons were used in the Yallourn power station, 314,000 tons went to industry and other power stations and 2,087,000 tons to the briquetting factory.

It was originally intended that briquettes should be made available generally as a domestic and industrial fuel. The shortage of coal has resulted in the diversion of a considerable quantity to a central power station. Industry is severely rationed and household briquettes are available only in small quantities for special purposes. Because of the unsatisfied demand and the general fuel shortage, the State Electricity Commission is developing another open cut at Morwell, near Yallourn. The Morwell open cut will be on the same great brown-coal field now being exploited at Yallourn. This one field in the Latrobe Valley covers about 40 square miles, is estimated to contain 6,000 million tons of coal, and includes the thickest known seam (800 feet) of coal in the world. An annual output of 8 million tons will be required from the Morwell open cut to supply the four briquette factories that will operate in conjunction with the open cut. Much of the overburden (about 44 feet deep) has been removed from the initial area of operation (the coal, 380 feet thick, was reached in May, 1951), and dredgers, railways and other equipment are now (early 1952) being erected.

Erection of the first two (a "pair") of the four briquette factories is also under way, and they are expected to be in full production by 1956, adding 1.3 million tons of briquetting capacity to the 600,000 tons capacity of the present Yallourn factory.

The cost of the open cut, the first pair of briquette factories and ancillary services was

estimated, when the scheme was entered into in 1948, to cost about £20 million. (Costs have risen considerably since that date.)

Planned briquette production will be sufficient by about 1956 to provide Victorian industries (excluding railways and gasworks) with about 60 per cent. of their total solid-fuel needs at that date and allow 200,000 tons a year for domestic use. It is estimated that 2,000 men will be employed permanently on operations and maintenance when full production is reached at the first pair of briquette factories, including open-cut operation. The two factories will require 4 million tons of raw brown coal a year. About 35,000 kW of electric-power generating capacity will be available as a by-product of briquetting; and from this capacity about 300 million kWh a year will be fed into the Commission's main distributing system.

The second pair of briquette factories has been approved and will be erected alongside the first pair. Plant has been ordered. At completion in 1958 of the second pair, which will add 1.3 million tons (and a further 35,000 kW of electric-power generating capacity as a by-product), the briquetting capacity of the State's five factories will be about 3.2 million tons a year, requiring about 10 million tons of raw brown coal annually. Because of shortage of finance, completion of this second pair of factories is likely to be deferred.

It is expected that the briquettes manufactured by the State Electricity Commission will at first be reserved mainly for State and public-utility purposes, mainly power production. Later on, briquettes are to be used for the manufacture of town gas by the Lurgi complete gasification process. It is possible that brown-coal dust will be used for firing locomotives, but only to the limited extent, probably; that dust is inevitably made in the drying of brown coal preparatory to briquetting. The production of cement in kilns fired with brown coal, is also an early possibility.

GAS PRODUCTION

Until recently, the manufacture and distribution of town gas in Australia was carried on by private firms, one State Government and several local-government authorities. In 1950, a second State entered the field when the Victorian Government passed the Gas and Fuel Corporation Act, as a result of which most of the Melbourne metropolitan area draws its gas supply from the government-controlled Corporation. The Corporation has statutory power to acquire non-government gasworks remaining in the State.

The calorific value of town gas made in Australia ranges from 478 to about 550 British Thermal Units a cubic foot. Statutory minimums vary between States and within some States; the average for the Commonwealth is, however, above 500 B.T.U.

The amounts of gas manufactured, maximum daily capacity of gas-making plants and the total sales of gas at 1939 and since 1945 are shown in the following tables—

GAS MADE	Metropolitan Areas:		Provincial Areas:	
	Production	Base Year = 100	Production	Base Year = 100
	* '000 cub.ft.		* '000 cub. ft.	
1939	18,918,504	100	1,490,036	100
1945	27,604,561	145.5	3,199,751	214
1946	29,451,755	155.5	3,305,814	222
1947	30,554,471	161	3,567,843	239
1948	32,128,902	169	3,796,343	254
1949	30,515,618	161	3,455,011	231

*Includes water-gas, etc.

DAILY GAS CAPACITY:	Metropolitan Areas	Provincial Areas
	'000 cub. ft.	'000 cub. ft.
1939	84,058	8,814
1945	104,891	13,868
1946	117,040	14,188
1947	119,800	15,456
1948	121,100	15,885
1949	122,587	16,038

GAS SALES:	Metropolitan Areas	Provincial Areas
	'000 cub. ft.	'000 cub. ft.
1939	16,407,070	1,276,888
1945	24,700,179	2,769,497
1946	25,743,480	2,826,559
1947	26,914,348	3,167,300
1948	28,302,315	3,204,064
1949	26,861,682	2,906,087

Of the total sales, 13,158,383,000 cub.ft. in 1939 and 22,363,192,000 cub.ft. in 1949, were domestic sales. Of the total Australian population 3,621,000 resided in the area supplied with gas in 1939 and 4,438,200 in 1949. Consumption of domestic gas per head in this area increased from 3,630 cub.ft. in 1939 to 5,040 cub.ft. in 1949.

The quantities of coal, coke, oil and tar used in production of town gas in 1938 and since 1945 were as follows—

MATERIALS USED:	Metropolitan Areas:				Provincial Areas:
	Coal Carbonised		Other Materials Used:		Coal Carbonised
	'000 tons	'000 tons	'000 gals.	'000 gals.	'000 tons
1939	1,026	54	20	3,618	94
1945	1,473	80	36	5,882	206
1946	1,568	92	—	5,951	209
1947	1,644	95	—	6,391	226
1948	1,690	116	—	8,699	242
1949	1,604	127	—	10,963	229

The mileage of gas mains, and number of services in those years were as follows—

MILES OF MAIN:	Metropolitan Areas	Provincial Areas
	miles	miles
1939	6,427	875
1949	7,612	1,212
NUMBER OF SERVICES:	Metropolitan Areas	Provincial Areas
1939	718,299	39,850
1949	857,432	47,427

The Australian gas industry was founded upon and designed to utilise a high-grade coal available from the South Maitland field in New South Wales. Because of the proximity of the field to the seaboard, the high quality of the coal and its adaptability to a wide range of industrial requirements, Maitland coal has been and still is being used unnecessarily for a number of purposes. This particular coal is now in very short supply and much still remains to be done in adapting to other fuels a great number of plants which do not fundamentally require a high-volatile coal. In these circumstances, the gas industry which really needs that coal has been gravely embarrassed by its shortage. It is for this reason that the Gas and Fuel Corporation of Victoria is proceeding with a project for the manufacture of Lurgi gas from brown-coal briquettes. The Lurgi plant will be located at Morwell and the gas will be transmitted by pipeline, about 90 miles long, to Melbourne. The initial capacity of the plant will be 18 million cubic feet a day in 1956. It is proposed to extend the plant to keep pace with the city's growing requirements. By 1965, it is estimated, annual production will reach 30,000 million cubic feet. In a further ten to fifteen years' time all town-gas supplies for Melbourne should be produced from brown coal.

Recent research into the production of synthetic liquid fuels from brown coal have resulted in the discovery that a combination of town-gas and liquid-fuel production is possible. By this method one-third of the heat units in Lurgi gas are converted to liquid fuel and two-thirds into the form of rich gas for distribution. The major advantage of combining the two processes is a considerable saving in capital expenditure, which in the past made uneconomical the production of synthetic fuels from brown coal. The Gas and Fuel Corporation of Victoria plans to order its first synthetic-petroleum plant in 1954. In twenty to twenty-five years' time the annual production of synthetic fuels is expected to reach 40 million gallons a year, of which 22 million gallons will be petrol.

Queensland has good supplies of high-volatile gas coals, but of rather high ash content. Those coals are used in Queensland gasworks except in the far north. The main objection to local gas coal is the friability of the coke and large proportion of breeze made. These disabilities arise mainly out of the high ash content and serve to emphasise the need for cleaning.

The companies engaged in iron and steel production in New South Wales (see Chapter 9) have a combined annual gas-making capacity of 25,000 million cubic feet. This coke-oven gas is used either in the iron and steel works, including by-product recovery, or in neighboring affiliated works.

In Western Australia it has been found practicable and economical to make town gas from selected Collie coal, of sub-bituminous rank, in

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standard carburetted water-gas plants. With this exception, Western Australia, South Aus-

tralia and Tasmania are dependent upon imports for gas-making coals.

PETROLEUM INDUSTRY

No large deposits of crude petroleum have yet been located in Australia or the Territory of Papua/New Guinea.

Seepages of oil and gas were first reported in Papua and New Guinea in 1911, and additional seepages have since been discovered.

A very small quantity of oil was recovered annually at Lakes Entrance, Victoria, by pumping; production ceased recently. Occurrences otherwise on the mainland have in general been limited to minor flows of natural gas, principally methane, and small amounts of oil, wax and natural gas encountered in water bores. Small deposits of wax and bitumen have also been found at the surface in different localities.

Geological surveys are being conducted and geophysical surveys, using modern methods, are being made in Australia and Papua, and if the results are satisfactory, drilling operations will follow. Exploratory drilling is already being conducted in Papua and further drilling is expected to be carried out in Queensland and Western Australia.

Although large-scale production of oil in Australia and the territories is still awaited, there is strong hope that eventually oil fields will be discovered. All the conditions con-

sidered essential for the occurrence of oil in commercial quantities are present in Papua; seepages in the formations being tested provide proof of the presence of oil, and commercial production has been achieved in Dutch New Guinea. Although conditions on the mainland are less promising than those in Papua, they are good enough to warrant thorough investigation. Structures suitable for the accumulation of petroleum are known to exist in Queensland, and the presence of petroliferous gas and traces of oil has been proved in the vicinity of Roma. Extensive sedimentary basins with a considerable thickness of marine sediments exist in Western Australia. Oil occurs in the tertiary rocks of Victoria and sediments of the same age are found in the Portland-Nelson-Mt. Gambier district of Victoria-South Australia.

The absence of supplies of indigenous natural crude oil makes Australia almost entirely dependent upon imports of petroleum from overseas, whether as refined products or as crude oil for local refining. Indigenous liquid fuels are confined to coke-oven benzol and power alcohol used for blending with motor spirit and the small output from the shale-oil refinery at Glen Davis, New South Wales.

REFINING AND RELATED ACTIVITIES

The first equipment to refine imported crudes was installed in 1924, but because of lack of indigenous supplies of natural crude oil a substantial refining industry has not been established in Australia, despite the encouragement of a generous tariff concession. Currently, imported refined products comprise 84 per cent. of Australian consumption.

Two refineries, composed of straight distillation units using imported crudes, were established in this country prior to the 1939-45 War—one in Melbourne and the other in Sydney. The Glen Davis refinery was completed in 1940. Post-war developments comprise new refineries established in Sydney and Melbourne and the expansion of the original Sydney refinery.

A considerable development in Australian refining is about to take place in accordance with overseas practice which now tends to favour refining at the market. Refineries installed or to be installed in Australia are favourably located for the purchase of crude oil at the best prices available on the world market. The plans recently announced for the expansion of Australian refinery capacity would provide for the processing of about 6½ million tons of crude oil in Australia by 1956, as compared with the current 900,000 tons. The estimated annual demand for petroleum products in 1956, when the announced refinery plans are expected to be complete, is 7½ million tons, demand having expanded by about 10 per cent. annually in recent years.

Additions to existing refineries include the plans of Bitumen and Oil Refineries (Aust.) Ltd. to install the first Australian catalytic-reforming unit. Vacuum Oil Co. Pty. Ltd. have announced a plan to increase their capacity at Altona by 500,000 tons annually, with the

provision of substantial catalytic cracking. The Shell Company of Australia Ltd. are erecting a refinery of 1 million tons annual capacity at Geelong, Victoria. Caltex Oil (Aust.) Pty. Ltd. and Anglo-Iranian Oil Co. Ltd. have announced that they will erect refineries of 1 and 3 million tons annual capacity respectively. The site of the Caltex Oil (Aust.) Pty. Ltd.'s refinery has not yet been announced. The refinery of the Anglo-Iranian Oil Co. Ltd. is estimated to cost £40 million to erect; it will be situated on Cockburn Sound, near Fremantle in Western Australia, will operate on Middle-East crude oil, and will be capable of producing a complete range of petroleum products.

The current annual Australian demand for petroleum products is more than 5½ million tons. The five local refineries are currently supplying about 16 per cent. of Australia's requirements. Standard products of the Australian oil industry are motor spirit, kerosene, automotive diesel oil, industrial and marine diesel oils, fuel oil, bitumen, lubricating oils and greases. The present annual demand for these products is broadly as follows—

	tons
Motor spirit	2,100,000
Automotive diesel oil	325,000
Industrial and marine diesel oils	800,000
Fuel oil	1,270,000
Bitumen	110,000
Lubricating oils and greases	175,000

Products from indigenous materials which can be blended with motor spirit are power alcohol, produced from molasses in Queensland, and benzol, produced in by-product coke-ovens in New South Wales. Current annual availability for this purpose is about 1½ million gallons of power alcohol and 1 million gallons of benzol.

Lubricating Oils and Greases

Plants for blending SPECIAL LUBRICATING OILS for such activities as the automotive and the textile industries are established in the capital cities of all States. Both Australian-produced and imported petroleum oils are used in these blending operations as well as special additions necessary in modern lubricants. Plants for the production of GREASE are established mainly in Brisbane, Sydney and Melbourne and operate on Australian-produced raw materials including petroleum-oil distillate, fats, etc.

Insecticides

Many of the firms which deal with petroleum production are equipped to handle a number of allied lines, and with specialised plant such products as insecticides based on petroleum oil are formulated and manufactured.

Reclaimers of oil

There are a few companies which operate in this field of the petroleum industry. As greater use is made of petroleum products there may be opportunities for further expansion.

Bitumen and Bituminised Products

The principal use for BITUMEN is in road making, but there are a number of other uses, such as the lining of pipes and the

manufacture of cements, dampcourses, floorings and roofing felts, flooring tiles, paints and paper laminations. It is estimated that pre-war the annual demand for bitumen was for about 100,000 tons a year and of this about 90 per cent. was used by State and municipal authorities in the maintenance and construction of roads. The present demand for bitumen appears to be in the region of 110,000 tons a year, but the demand is expected to increase considerably as labour and other shortages at present affecting the implementation of public works are overcome. But for the restrictive effect of interstate freight, Australian production at present would be able to satisfy local requirements of bitumen in full. The cost of Australian-produced bitumen is less than the landed cost of imported bitumen, but the difference is insufficient to cover interstate freight costs. This makes it difficult for the Australian material to compete with the imported in States where there is no local production.

In general, there is a fairly wide scope for increased activity in manufacture of BITUMINISED PRODUCTS, and no doubt as bitumen becomes available in those States in which it is not produced at present the manufacture of bituminised products will increase. Australia has ample capacity in her existing factories to cope with the probable future supply of their raw material.

ELECTRIC-POWER GENERATION

The generation of electric power is basic to any modern manufacturing economy. Its importance to Australia as the main source of power for all manufacturing activities has been growing rapidly in recent years. The total horsepower of engines of all types installed in factories increased from 1.2 million in 1936-37 to 1.5 million in 1938-39, to 2.4 million in 1946-47, to 2.5 million in 1947-48 and to 2.8 million in 1949-50—an increase of 87 per cent. in eleven years. In 1949-50 the capacity of machinery using purchased electric power in factories totalled 2.4 million h.p.

The increase has been almost entirely in respect of machines using purchased electric power, the horsepower of all other categories of machines remaining fairly constant over the whole period. All classes of industry have participated in this development, although it is naturally more noticeable in the highly-mechanised industries. Considerable further development will be necessary, however, if Australia is to approach the degree of mechanisation of industry in such countries as the United States of America.

Domestic demand for electricity has also increased substantially in recent years. The number of new homes built since the 1939-45 War is, perhaps, the main factor in this increase, but the greater demand for electricity in the average home has been a major contributing factor. The use of domestic electrical equipment such as hot-water systems, refrigerators, stoves, radiators, vacuum cleaners and other similar appliances has grown rapidly, particularly in the post-war period.

The extension of electric supply to rural areas has resulted not only in its use for domestic purposes, thus improving the standard of rural amenities, but also in its application to a variety of tasks associated with

farming, especially in the dairying industry. This tendency in Australian agriculture is likely to continue. An important feature of rural electrification is the opportunity which it offers for the decentralisation of secondary industry by providing a source of power comparable in price and quantity with that available in metropolitan areas. The influence of electricity supply on industrial decentralisation is illustrated in Tasmania, where important industrial development has taken place outside the main urban areas.

In response to the increase in demand, the total of electricity generated in Australia increased from 4,688 million kWh in 1938-39 to 8,368 million kWh in 1947-48, to 9,053 million kWh in 1948-49, and to more than 10,000 million kWh in 1950-51. This increase is still continuing. Industrial users account for about two-fifths of total consumption of purchased electricity, and domestic users for almost one-third.

Of the total power generated in 1949-50, about 38 per cent. was produced in New South Wales, 31 per cent. in Victoria, 12 per cent. in Tasmania, 9 per cent. in Queensland, 6 per cent. in South Australia and 4 per cent. in Western Australia.

Steam plant produces about 80 per cent. of the total power generated, hydro-electric plant 17 per cent., and internal-combustion plant 3 per cent. It is interesting to compare these proportions with those relating to installed capacity. Of the total installed capacity of generating plant at June, 1950, about 82 per cent. was steam plant, 13 per cent. hydro-electric plant and 5 per cent. internal-combustion plant. Internal-combustion plant is used mainly in small local power-stations in country areas, and a large proportion of such plant would be used only for limited peak-load periods. There is a tendency in all main-

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land States for these isolated local undertakings to be absorbed by the extension of the larger inter-connected systems, or by regional grouping arrangements undertaken by neighbouring local-government authorities.

Despite the large increase in power generated, it has not been sufficient to cope with the increase in demand in recent years, particularly during the winter peak period, and it has been found necessary to introduce some form of power rationing at various times in all States. Queensland and South Australia have not been obliged to restrict supply on account of plant capacity, but only when coal shortages, poor-quality fuel or plant breakdowns have made such a step necessary. The mainland States are all dependent in varying degrees on black coal, supplies of which have been irregular and inadequate. In this respect, Queensland and Western Australia have been rather better off than the remaining States, due largely to supplies of local coal. The Queensland winter also is comparatively mild and results in a relatively smaller peak load. Victoria is endeavouring to reduce its dependence on New South Wales coal by further developing brown-coal and hydro-electric resources on a large scale, and South Australia is developing deposits of low-grade coal by open-cut methods at Leigh Creek.

A main cause of power shortages, however, is the inadequacy of generating capacity largely due to restriction of development programmes during the 1939-45 War. These deficiencies are being overcome and provision is being made for future increases in demand, by a number of large-scale projects which are under construction or proposed by

electricity-supply authorities in all States. Problems likely to retard the programme include—

(a) The time required to obtain and install high-pressure boilers (600 to 1,250 lbs. per sq. in.). This applies mainly to the Australian portion of the production of the boiler plant and its installation. At the present time no manufacturer in Australia is making complete high-pressure boilers. One of the leading companies in this field expects to begin such manufacture in a year or so. Two other large manufacturers import high-pressure boiler parts and assemble the complete unit in Australia. (See Chapter 12, "Machinery, Plant, Equipment and Apparatus, Not Elsewhere Included".)

(b) Shortage of structural steel for the erection of power stations.

(c) Shortage of Australian-made large-capacity transformers, due partly to the shortage of some important materials and partly to lack of skilled tradesmen in the transformer industry, which is at present working to only about two-thirds of its capacity.

(d) Shortage of large-capacity insulators.

(e) Shortage of copper strand.

(f) Availability of finance.

The following table indicates the capacity of major generating equipment installed at June, 1951, plant under installation as at June, 1951, which is estimated to be in service by the end of 1956, and the proposed installed capacity of known projects not yet commenced—

ELECTRIC POWER SUMMARY:	Installed at 30/6/51 (a)	Under Construction at 30/6/51 and Estimated to be in Service by 1956	Estimated Total Capacity by 1956	Proposed Capacity of Projects not yet Commenced
	kW	kW	kW	kW
Snowy Mountains Scheme	nil	180,000	180,000	2,850,000
New South Wales	881,930 (b)	1,077,100	1,959,030	358,700 (d)
Victoria	646,427	728,400	1,374,827	294,600
Queensland	224,261	325,450	549,711	237,000 (e)
South Australia	175,260	154,000	329,260	63,000
Western Australia	113,560	82,500	196,060	120,000
Tasmania	194,400	205,000	399,400	153,000
Totals, Australia	2,235,838	2,752,450	4,988,288 (c)	4,076,300

(a) Continuous maximum rating of installed plant, limited as case may be by the rating of generators, prime movers or boilers; excludes some generating plant installed by manufacturers primarily for their own purposes, but used partly for public supply.

(b) Subject to revision.

(c) Includes all plant estimated to be in service by 1956. Some projects may, however, be delayed by shortages of materials, equipment and labour, etc. Retirement of equipment, through obsolescence and other reasons, may considerably reduce this estimate of total installed capacity by 1956.

(d) Includes an estimated installed capacity of 35,000 kW in the Clarence Gorge hydro-electric scheme.

(e) Excludes estimates of any power which may be made available from the proposed Burdekin River scheme in Queensland.

At June, 1951, the proportions of steam, hydro and internal-combustion installed generating capacity were 82 per cent., 13 per cent. and 5 per cent. respectively. The following figures show the significant changes that are likely to take place in these proportions when the projects at present under construction or proposed are completed—

MOTIVE POWER COMPARISON:	Steam	Hydro	Internal Combustion	Totals
	%	%	%	%
At 30/6/51	82	13	5	100
At 1956	78	19	3	100
At 1961	71	26 (a)	3	100

(a) Includes 560,000 kW which is expected to be available from the Snowy Scheme by 1959.

It will be noted that the estimated major changes in proportions will occur between steam-generated and hydro-generated power. The relative importance of the latter is likely to increase even further after 1961 as the installed capacity of the Snowy Scheme is progressively increased and hydro potentialities in New South Wales, Queensland and Tasmania are further developed. However, the fact that a great part of the generating equipment under installation is steam operated will progressively increase the demand for black

coal. The thermal projects, therefore, are dependent upon substantial improvement being effected in the quantity and regularity of coal production.

SNOWY MOUNTAINS AREA

The Commonwealth Government has set up the Snowy Mountains Hydro-Electric Authority to develop the water resources of the Snowy Mountains area in south-eastern New South Wales. Its main functions are to divert and store water for the generation of electric power and for irrigation. Power generated will in the first instance be fed into the New South Wales interconnected system at Cooma. After making allowances for Commonwealth requirements, surplus power will be shared by New South Wales and Victoria in the proportions of two-thirds and one-third respectively.

No detailed estimate of the capital cost of the project has been prepared, but preliminary investigations have indicated that the overall cost will be about £220 million, including nearly £100 million for transmission lines and

An outline is provided below of extensions under way or planned (as at 31st December, 1951) of electric-power generating capacity in Australia.

equipment. Major works include 8 dams, 86 miles of tunnels, 490 miles of racelines and 16 power stations.

The planned ultimate installed capacity of plant exceeds 3 million kW, which is greater than the total present installed capacity of all generating stations in Australia.

The first power is expected to be available about mid-1954, and by 1959 it is planned to have 560,000 kW in service. The whole scheme, it is estimated, will take twenty-five years to complete. Work has already commenced on site clearing and a number of access roads have been constructed. A contract for the Guthega project (60,000 kW), was recently awarded to the Norwegian firm of Selmer; under its terms, the work should be completed by June, 1954.

NEW SOUTH WALES

The Electricity Commission of N.S.W. has been constituted to assume responsibility for the generation, main transmission, and, with certain reservations, the distribution of electric power in New South Wales. This authority was set up under the Electricity Commission Act of 1950 and is empowered to take over or acquire these specific activities of the major existing electricity undertakings in the State. The most important bodies to be affected by this legislation are the Railways Department, Sydney County Council, and the Southern Electricity Supply of New South Wales, whose assets in part or in total will be acquired by the new authority.

Since the 1939-45 War demand for electric power has exceeded supply with the position becoming progressively more acute in the past two or three years. However, action is being taken which will considerably augment generating capacity, particularly in the system supplying the Sydney metropolitan area. It has been estimated that completion of the major projects, brief details of which are included hereunder, will bridge the gap between supply and demand by 1954.

At Bunnerong (present capacity 350,000 kW) and Pyrmont (50,000 kW) work is proceeding on the installation of equipment to increase capacity by 50,000 kW and 200,000 kW respectively, while at Balmain (48,000 kW) capacity is being increased by 50,000 kW. At the White Bay power station one 50,000 kW unit was placed in service during 1951 (164,000 kW now installed) and another of a similar capacity is being installed; it is planned to increase capacity by a further 100,000 kW at a later date. New stations, which will supply the interconnected system, are under construction at Lake Macquarie, 300,000 kW, by 1955; Tallawarra (Lake Illawarra), 120,000 kW, by 1955; and Wallerawang, near Lithgow, 60,000 kW initially and 120,000 kW ultimate capacity.

In addition, "packaged" (pre-engineered) steam units and diesel equipment have been ordered from the United States and the United Kingdom with a view to supplementing power supplies as quickly as possible. These units, which total 93,000 kW, will be installed at Penrith, Liverpool, Warringah, Port Kembla, Maitland, Newcastle, and Kempsey. The major portion of this capacity is expected to be in service by 1953.

Other stations under construction, the output of which will be fed into the interconnected system, are at Lithgow, 22,500 kW, and Koolkhan, near Grafton, 10,000 kW. At Hume Weir, near Albury, two 25,000 kW units will be installed and the power generated shared equally by New South Wales and Victoria.

It is planned that completion of the foregoing projects should add to the State's installed capacity (931,900 kW at late 1951) about 1,027,000 kW of generating capacity by 1956. Demand, however, is increasing rapidly from industrial, domestic and public-utility sources and a steep increase in consumption is expected when unrationed supplies of power become available. The electrification of the four main railway lines radiating from Sydney, upon which work has already commenced, will contribute considerably to the increased demand; it involves the construction of 910 single-track miles.

The proposed Clarence Gorge hydro-electric and irrigation scheme in northern New South Wales is estimated to be capable of producing between 300,000 and 400,000 kW. This project, if proceeded with, could form a power link between the New South Wales and Queensland systems.

Recently a Canadian organisation was invited to investigate the practicability of constructing a station in the Nymboida catchment, near Grafton, to develop initially about 35,000 kW.

VICTORIA

By far the greater part of Victoria, including the metropolitan area of Melbourne, is

supplied with power by the Electricity Commission of Victoria. This authority is vested

with the responsibility for developing the State's power resources, the most important of which are the brown-coal deposits in the Latrobe Valley and the hydro potentialities of the north-eastern Victorian highlands. An extensive plan for the further development of both these areas is now in progress.

In the Latrobe Valley generating capacity at the Yallourn power station (183,000 kW, including 8,000 kW capacity which is a by-product of the Yallourn briquette factory, adjoining) is being increased by 100,000 kW, which it is anticipated will be installed by 1954; provision has been made for a further increase of 100,000 kW. If the planned construction schedule is maintained the station's installed generating capacity will be 383,000 kW by 1956. At Morwell the Commission has commenced construction of four briquette factories which includes the installation of electric-generating equipment with a total capacity of 150,000 kW for power to operate the briquette factories. As a by-product (that is, excess power) of briquette manufacture, it has been estimated that when the first two factories are in production, 35,000 kW capacity will be available to the State system and a further 35,000 kW capacity when the second pair of factories is in operation. It is planned to have the first pair in production by 1955-56 and the second by 1958.

In the north-eastern highlands in the Kiewa area, work is in progress on sections of a major hydro-electric scheme designed to develop a total of 289,000 kW. Generating equipment with an installed capacity of 26,000 kW is already in service. The project is to be constructed in five major stages, and includes two main water storages and six power stations; five of the power stations will be located underground.

Development of existing power stations in the metropolitan area includes the installation of additional generating capacity as follows (existing capacity in parentheses): Newport (311,000 kW), 30,000 kW; Spencer Street (44,000 kW), 45,000 kW; and Richmond (15,000

kW) 38,000 kW. The major portion of this capacity is expected to be in service during 1952.

Other projects, the construction of which is in progress, are the two regional diesel stations at Shepparton and Warrnambool, each to have an installed capacity of 10,380 kW. At the Shepparton station a small portion of the capacity is already in service; the Shepparton project is part of the Commission's plan to provide power to the whole Murray Valley area, and includes the construction of a 220,000-volt transmission line from Kiewa to Mildura by way of Shepparton.

With a view to supplementing installed capacity (shown in parentheses below) as quickly as possible, steps have been taken to purchase "packaged" steam generating units totalling 60,000 kW for installation within the next two years at Geelong (10,500 kW), 30,000 kW; Ballarat (5,900 kW), 20,000 kW; and Mildura (4,500 kW), 10,000 kW.

In conjunction with the State Rivers and Water Supply Commission's project to increase the storage capacity of Eildon Weir, it is proposed to install hydro-electric generating equipment with a capacity of 135,000 kW (including 15,000 kW that will result from reconstruction of present installed capacity at the Weir). Construction of the new retaining wall has commenced and is scheduled for completion in 1955. The generating plant required for the power station is on order. Victoria will also benefit from the output of one of the two 25,000 kW units for installation at the Hume Weir; these units are planned to be in service during 1956.

It is estimated that the above projects, including Eildon Weir, will increase the State's installed generating capacity (646,500 kW at June, 1951) by about 728,000 kW at 1956. Demand for power is expected to rise considerably in the next few years, particularly when unrationed supplies are available and electrification of the Gippsland and Geelong rail lines are completed.

QUEENSLAND

The State Electricity Commission is the authority responsible for co-ordinating the supply of electric power throughout Queensland. The principal organisations engaged in the production of power are the City Electric Light Co. Ltd., Brisbane City Council, Toowoomba Electric Light and Power Co. Ltd., and four Regional Electricity Boards—Wide Bay-Burnett, Capricornia, Townsville and Cairns. Brief details of the major projects under construction or proposed by these organisations to increase generating capacity are set out hereunder.

In the Brisbane metropolitan area power is supplied jointly by the City Electric Light Company Ltd. and the Brisbane City Council. The first-mentioned organisation, which also serves a large area of south-eastern Queensland, is constructing a new station, Bulimba "B", on a site adjacent to Bulimba "A" (95,000 kW); the new station is planned to have an initial capacity of 30,000 kW by 1953 and an ultimate capacity of 180,000 kW.

The Brisbane City Council operates a power station at New Farm (75,000 kW) and supplies power for industrial, domestic and tramway-traction purposes. Work is proceeding on the Council's new station at Tennyson, which is

designed to have 60,000 kW in service by 1955, with provision for addition of a further 60,000 kW at a later date. It is planned also to install a "packaged" unit of 10,000 kW at this station as soon as possible.

Developments near Brisbane include the erection of a "packaged" station at Ipswich of 10,000 kW, and the small hydro station at Somerset Dam of 3,200 kW. The latter project, which is nearly completed, is designed to augment power supplies in the Brisbane area during winter periods.

At Howard, near Maryborough, the Wide Bay-Burnett Regional Electricity Board (with 7,000 kW capacity at June, 1951) is constructing a new station with an ultimate capacity of 52,500 kW, of which 15,000 kW was placed in service during September, 1951; a further 22,500 kW is expected to be in operation by 1954.

The Capricornia (with 7,300 kW capacity) and Townsville (with 15,000 kW capacity) Regional Electricity Boards are each building a station with a planned installed capacity of 52,500 kW, at Rockhampton and Townsville respectively. Each authority expects to have 37,500 kW of the new capacity in service by 1954.

Work has commenced on site clearings, etc., for the proposed hydro-electric station at Tully Falls, and tenders have been called for the major constructional work on the scheme. It is planned to install generating equipment with a capacity of 72,000 kW. Development of the power potential of the area is the responsibility of the Cairns Regional Electricity Board (which has 12,000 kW capacity). To cater for demands pending completion of the hydro scheme the Board plans to install additional diesel units at Cairns, Innisfail and Atherton totalling 3,750 kW.

Other developments of lesser magnitude are plans to increase capacity at Mackay (with 5,000 kW capacity) by 5,000 kW and Bowen (with 1,000 kW capacity) by 1,000 kW. In western Queensland towns steps are being taken to install new plant and effect improvements to existing equipment. In general the new plant will consist of small internal-

combustion units varying in size from 100 to 450 kW according to the requirements of the towns.

In conjunction with the proposal to construct a large dam on the Burdekin River for irrigation and flood control, it is planned to build a hydro-electric station. Preliminary surveys indicate that about 75,000 kW could be generated. Initially, Townsville and adjacent areas would benefit from implementation of the scheme, which would take about fifteen years to complete.

It is estimated that the projects under construction in Queensland will increase installed generating capacity (239,300 kW at late 1951) by about 310,000 kW at 1956. A proportion of the increases planned in the metropolitan area will be called on to contribute power for the electrified suburban railways, a scheme on which work has already commenced.

SOUTH AUSTRALIA

The supply of electric power is in general the responsibility of the Electricity Trust of South Australia. A major station located at Osborne, near Adelaide, has an installed capacity of 139,000 kW. The Trust has at present two major projects in hand—capacity at Osborne is being increased by 120,000 kW, of which 60,000 kW should be in service by 1953. At Port Augusta a new station is under construction, which will have an ultimate installed capacity of 90,000 kW by 1956. These two stations will be interconnected by power lines passing through Port Pirie. The boilers

of both are designed to burn coal from Leigh Creek.

Projects of lesser importance include increases in capacity at Port Lincoln by 3,000 kW and Leigh Creek by 3,000 kW.

It is estimated that the foregoing projects will contribute about 154,000 kW to the State's system (175,260 kW at June, 1951) at 1956. However, it is planned to electrify the suburban railways and some of this increased capacity will be used to supply power for traction purposes.

WESTERN AUSTRALIA

Major developments in Western Australia, where the supply of electric power is controlled by the State Electricity Commission, include the South Fremantle power station and the South-West Power Scheme. The Commission operates a station at East Perth, with an installed capacity of 53,000 kW. At South Fremantle 50,000 kW of capacity was recently placed in service, and work is proceeding on the installation of a further 50,000 kW. It is proposed to install a new 30,000 kW unit at East Perth.

Under the South-West Power Scheme, capacity at the Collie Station (5,000 kW) is being increased to 12,500 kW. A station of 90,000 kW is proposed at Bunbury. The scheme is designed to provide power to towns and industries located in the south-west corner of the State, and at a later stage a link will be effected with the metropolitan system to permit an interchange of power.

It is estimated that the projects under construction will increase installed capacity (138,560 kW at 1951) by 57,500 kW at 1954.

TASMANIA

The Hydro-Electric Commission of Tasmania is responsible for developing the State's hydro-electric resources, which are estimated at about one-third of the total Australian hydro-electric potential. The Commission is at present constructing stations which it is estimated will increase installed capacity of 194,500 kW by about 205,000 kW at 1956.

Major projects include Nive River (Tungatinah), 100,000 kW; Tarraleah, 15,000 kW;

Butler's Gorge, 12,000 kW; and Trevallyn, 80,000 kW. The last-mentioned station is designed primarily to supply power to the Australian Aluminium Production Commission's works at Bell Bay; any surplus power will be fed into the Tasmanian system. At a later stage another 25,000 kW will be added to the Nive River scheme, and proposals are under investigation for the construction of two new stations, Wayatinah 100,000 kW, and Lake Echo 28,000 kW.

Part Three: Basic Statistics

COMPARATIVE STATISTICS, 1938-39/1949-50

NUMBER OF ESTABLISHMENTS AT 1938-39 AND 1949-50

NUMBER OF EMPLOYEES AT 1938-39, 1949-50, JUNE 1950, SEPTEMBER 1951

Activity (Statistical Sub-classes used by Commonwealth Statistician, 1949-50)	Establishments		Employees			
	1938-39	1949-50	1938-39	1949-50	June 1950 (a)	Sept. 1951 (a)
Coke Works (b)	no. 10	no. 8	no. 868	no. 1,239	no. (c)	no. (c)
Briquetting and Pulverised Coal (d)	1	1	266	418	399	382
Gas Works—						
Government	31	2	297	174	13,106 (f)	13,998 (f)
Local Authority	(e) 31	31	(e) 266	266		
Other	76	67	2,634	3,375		
Electric Light and Power Generation—						
Government	19	36	2,143	4,739	1,336 (h)	1,111 (h)
Local Authority	162	169	1,628	3,351		
Other	214	153	2,727	1,505		
Mineral Oils (g)	33	53	440	1,707		
Lime, Plaster of Paris, Asphalt (h)	(h)	(h)	(h)	(h)		
Totals (j)	546	520	11,003	16,774	14,841	15,491

STATISTICAL SUMMARY, 1949-50

EMPLOYMENT, MALE AND FEMALE

SALARIES AND WAGES PAID, IN TOTAL AND PER PERSON ENGAGED

VALUE OF PRODUCTION

VALUE OF MATERIALS, POWER, FUEL, REPAIRS, etc.

VALUE OF OUTPUT

See Explanations,
Appendix IV

Activity (Statistical Sub-classes used by Commonwealth Statistician, 1949-50)	Employment			Salaries and Wages Paid		Value of Pro- duction	Value of Materials, Fuel, etc. Used	Value of Output
	Males	Females	Persons	Total	Per Person Engaged			
Coke Works (b)	no. 1,208	no. 31	no. 1,239	£'000 785	£ 634	£'000 1,228	£'000 3,959	£'000 5,187
Briquetting and Pulverised Coal (d)	412	6	418	261	624	418	426	844
Gas Works—								
Government	174	—	174	91	523	102	311	413
Local Authority	264	2	266	124	466	123	261	384
Other	3,346	29	3,375	1,812	537	3,438	7,493	10,931
Electric Light and Power—								
Government	4,711	28	4,739	2,831	597	5,468	8,559	14,027
Local Authority	3,324	27	3,351	1,794	535	5,574	5,424	10,993
Other	1,487	18	1,505	841	559	1,798	3,688	5,486
Mineral Oils (g)	1,633	74	1,707	893	523	4,540	11,752	16,292
Lime, Plaster of Paris, Asphalt (h)	(h)	(h)	(h)	(h)	(h)	(h)	(h)	(h)
Totals (j)	16,550	215	16,774	9,432	562	22,689	41,873	64,562

Explanatory Footnotes to Both Tables

- (a) These employment figures are taken from monthly payroll-tax returns and differ slightly from the other employment figures, which are supplied on annual factory returns.
- (b) Also includes by-product coke-oven plant (including coal-washing and by-product recovery sections) at each of the two integrated iron and steel works (both in New South Wales).
- (c) Grouped with "Lime, Plaster of Paris, Asphalt" and "Fibrous Plaster and Products" (of the Commonwealth Statistician's Class I, "Treatment of Non-metalliferous Mine and Quarry Products")—see page 41.
- (d) Briquetting only.
- (e) At 1938-39 the sub-class "Local Authority" included the present sub-classes "Government" and "Local Authority".
- (f) Separate figures for each sub-class were not published.
- (g) Also includes shale-oil production; prepared lubricants such as greases; and oil reclamation. Does not include, where carried on as the sole or major activity, bitumen emulsions and cutbacks and bituminised products, which are included in the sub-class "Lime, Plaster of Paris, Asphalt"—see following footnote.
- (h) Statistics of the sub-class "Lime, Plaster of Paris, Asphalt" are grouped in this study in Chapter 2, "Products of Crude and Treated Non-metallic Minerals" (see page 41), as the greater part of activity covered by the sub-class appears to be in the manufacture of lime and plaster of paris. In this study,

- however, the "Asphalt" portion of the sub-class is dealt with as an activity in "Fuels, Lubricants, Light, Power"; the activity includes the manufacture of bitumen emulsions and cutbacks; flooring and roofing felts; sarking, bituminised paper wrappings and linings (including those reinforced with sisal, hessian, etc.); "asphalt" (so-called) floor tiles (asbestos based, the dark shades of tiles being bituminised); bituminised dampcourses, cements, mastics; bitumen paints; and similar bituminised products.
- (j) Consideration and comparison of totals must take into account the effects stated in footnotes explaining the composition of certain sub-classes and figure units.

Chapter 2:

PRODUCTS OF CRUDE AND TREATED NON-METALLIC MINERALS

Part One: Structure of Established Manufacturing Activities

ACTIVITIES concerned with preparation of non-metallic minerals and manufacture of products mainly of non-metallic mineral origin are established in Australia as listed below, the extent of association of activities being shown by annotation and bracketing. The listing is intended to be indicative, but not necessarily fully inclusive.

SALT CRUSHING, WASHING, GRADING, STERILISING: In 1949-50, there were 17, and in 1948-49 there were 15, establishments wholly or mainly engaged in this activity. Four of the 1948-49 establishments each employed less than 4 persons, 6 each from 4 to 10 persons, two each from 21 to 50 persons, two each from 51 to 100 persons, and one employed 140 persons. The five largest establishments employed 370 persons out of the activity total of 421 persons. (Employment is averaged over twelve periods of one month each. There is a seasonal peak of employment in the activity.) Only five of the establishments produce "refined salt", that is, salt which is sterilised by heat, then sieved, recrushed and graded to grain sizes for processing of foodstuffs and for table salt. The other establishments, mostly small, produce one or more grades of coarse salt by crushing, washing, grading. Table salt (refined salt made free-running by addition of 1 per cent. of magnesium carbonate) is made by one of the largest of the salt harvesting and refining companies. Stock salt-licks are made by a few of the refineries (and by other companies).

STONE, MARBLE, SLATE, TERRAZZO—

Monumental Masonry

Building Masonry

Dressed Stone

Dressed Slate

Terrazzo Products

In 1949-50 there were 169, and in 1948-49 there were 167, establishments wholly or mainly engaged in one or more of the activities shown at the left. Of the 1948-49 establishments, 121 each employed up to 10 persons, 29 each from 11 to 20 persons, 14 each from 21 to 50 persons, 2 each from 51 to 100 persons, and 1 employed 105 persons. The establishments each employing up to 20 persons employed 1,017 persons out of the activity total of 1,666 persons. Most establishments engaged on monumental masonry are small, specialising in cemetery work, and usually obtaining their stone requirements in dressed blocks from a few large establishments with stone-dressing machinery (and usually quarries) and engaged in either building masonry or monumental masonry as the main activity. (There would be some monumental masonry works not using power and employing less than four persons regularly, and therefore not recorded as factory establishments.) Slate for paving, laboratory slabs, electrical switchboards, etc., is supplied by one specialist and a few of the building-masonry works. Terrazzo products are made by several establishments, the proprietors of which also usually do on-site work; one such company is known to make scagliola columns, etc., when required.

LIME, PLASTER OF PARIS: These activities are grouped with some bituminised products in official statistics, but no interactivity is known. In 1949-50 there were 101, and in 1948-49 there were 95, establishments wholly or mainly engaged in one of the three activities (see also below). Of the 1948-49 establishments 60 each employed up to 10 persons, 19 each from 11 to 20 persons, 14 each from 21 to 50 persons, and 2 each from 51 to 100 persons. Out of the total of 1,191 persons employed in the 95 establishments, a little less than half were in the not-more-than-20 group. (See Chapter 1, "Fuel, Lubricants, Light, Power", for comment on bituminised products.)

Lime (Quick, Hydrated, Agricultural): There are about 30 manufacturers, including three cement makers which make lime for sale, and five companies (two chemical, one sugar-refining and two paper-pulp) making lime for own usage. Only about one-third of the manufacturers operate modern lime kilns.

Plaster of Paris (Gypsum Treatment for Plasters, including Building, Pottery, Dental, Modelling): About eleven establishments; four operated by the principal producer in Australia, Australian Gypsum Products Pty. Ltd., which is also engaged in the manufacture of fibrous plaster, gypsum wallboard, mineral wool and mineral wool products; and three operated by one other company, Colonial Sugar Refining Co. Ltd., also engaged in sugar milling and refining, and the manufacture of chemicals, asbestos-cement products, hardboard, softboard, fibrous-plaster wallboard, gypsum wallboard and asbestos-base floor tiles.

PORTLAND CEMENT (Grey only): There are 11 companies making cement. In 1948-49, 10 companies operated eleven establishments. Nearly 100 persons were employed at one establishment; the other ten establishments, each with more than 100 employees, collectively employed 1,980 persons. (Employment figures do not include employees used in quarrying, mining, power generation, transport, etc.) One company operates a mine from which it draws coal for cement making and power generation; another company draws its coal from mines operated by its parent company; and at least five other companies mine their coal through subsidiary or associated companies. Three of the companies also make lime for sale (one of them also makes sulphuric acid), and one other company also makes asbestos-cement products. (Two other plants, to be operated by new companies, are in course of erection.)

CLAY BRICKS AND TILES, CLAY AND OTHER REFRACTORIES: In 1949-50 there were 286 establishments, and in 1948-49 278 establishments wholly or mainly engaged in manufacture of one or more types of such products (see also below). Of the 1948-49 establishments, 110 each employed up to 10 persons, 44 each from 11 to 20 persons, 76 each from 21 to 50 persons, 34 each from 51 to 100 persons and 14 each more than 100 persons. The more-than-50 group employed 4,416 persons out of the activities total of 8,353 persons, and the not-more-than-20 group employed 1,273 persons.

Clay Bricks and Roofing Tiles: Over 200 establishments. One company, Wunderlich Ltd., engaged in tile production operates six establishments and produces a substantial portion of the total output of tiles. Several manufacturers of bricks also make tiles.

Refractories, Clay and Other (other than Dielectric): About thirty manufacturers. One company Newbold General Refractories Ltd., is pre-eminent in this field by range and quantity of production, which includes most of the non-clay refractories made in Australia, and operates three establishments; one of the establishments is close to the iron works, steel works and steel mills of The B.H.P. Co. Ltd., and the other two are close to the iron works, steel works and steel mills of Australian Iron & Steel Ltd. (subsidiary company of The B.H.P. Co. Ltd.), Newbold's throughout its existence being the principal supplier of refractory bricks and pieces to the Australian iron and steel industry. (A number of brickyards also make firebricks as a lesser activity.)

EARTHENWARE, FIRECLAYWARE, STONEWARE, TERRA COTTA, PORCELAIN: In 1949-50 there were 124 establishments and in 1948-49, 120 establishments wholly or mainly engaged in pottery activities. Of the 1948-49 establishments 52 each employed up to 10 persons, 33 each from 11 to 20 persons, 15 each from 21 to 50 persons, 13 each from 51 to 100 persons, and 7 each more than 100 persons. The latter 7 establishments employed 1,111 persons out of the activity total of 3,272 persons; and the not-more-than-20 group employed 810 persons.

Earthenware (other than Tableware), Fireclayware, Stoneware, Terra-cotta Ware (other than Roofing Tiles): The usual activities of most potteries place the greater number of establishments within this group. Some of the larger potteries make all or most of the various wares, and operate clay pits. Other potteries tend to specialise in a ware and even in a limited range of products of that ware (such as sewerage and drainage pipes); not infrequently this is determined by the clay that is readily available. (Some brick and/or tile makers also make pipes and fittings and similar products.)

Tableware, Art Pottery and Ornaments: There are only three makers, all general potteries, of tableware and kitchenware, with cups, saucers, jugs, etc., in utility earthenware as the principal items; one also makes semi-vitrified hotelware, and another also makes a small range of fine earthenware tableware and ornamental ware in bone china. There are several specialist makers of art pottery, mostly small establishments.

Wall and Floor Tiles: Four manufacturers only. Australian Tesselated Tile Co. Pty. Ltd., Melbourne, Vic., makes wall and floor tiles in wide range, and recess fittings (also sewerage pipes and other stoneware, and firebricks). R. Fowler Ltd., Sydney, N.S.W., Melbourne, Vic., and Adelaide, S.A., general potteries, makes a wide range of wall and floor tiles, and recess fittings; they have suspended wall-tile manufacture for the time being. Redondo Tile (Aust.) Pty. Ltd., Sydney, N.S.W., a wholly-owned subsidiary company of Australian Consolidated Industries Ltd. (see "Glass and Glass Products", next listing) makes wall tiles and no other product. Commonwealth Ceramics Pty. Ltd., a subsidiary company of Electricity Meter and Allied Industries Ltd. (manufacturers of electrical machinery, equipment and appliances, radios, other machinery and equipment, plastics products), makes wall-tiles, dielectric porcelain pieces, and general porcelain products.

Insulators for Overhead Power-lines and Switching Structures: Three principal manufacturers. Two are specialists, making mainly high-tension types of wide variety—Australian Porcelain Insulator Co. Pty. Ltd., and Sunshine Porcelain Potteries Pty. Ltd., both of Melbourne, Vic. The third manufacturer, Koster's Premier Potteries Ltd., Adelaide, S.A., also makes electric-jug bodies, but is principally engaged in making low-tension, medium-tension and high-tension insulators, particularly for South Australian requirements. R. Fowler Ltd. also make small quantities of high-tension and low-tension types.

Refractory and Non-refractory Pieces (Dielectric Porcelain): About ten manufacturers of significance, mostly specialists. One of the largest, Nilsen Porcelains (Aust.) Pty. Ltd., is a subsidiary company within a group of companies prominent in manufacture of electrical equipment and accessories. Another, Commonwealth Ceramics Pty. Ltd., is also part of a large group of manufacturing companies within the electrical and electronics industries (see also "Wall and Floor Tiles", above).

GLASS AND GLASS PRODUCTS: In 1949-50 there were 137 establishments and in 1948-49 there were 135 establishments wholly or mainly engaged in one or more of various activities within the glass-products industry, including fabricating, glazing, etc.—see below for an outline of each broad group of activities. Of the 1948-49 establishments 70 each employed up to 10 persons, 26 each from 11 to 20 persons, 21 each from 21 to 50 persons, 9 each from 51 to 100 persons, and 9 each more than 100 persons. The latter 9 establishments employed 4,982 persons out of the industry total of 7,066 persons, and the not-more-than-20 group employed 764 persons. The glass-

products industry in Australia (excluding mirror-making, glazing, etc.) consists mainly of one company, Australian Consolidated Industries Ltd., which owns seventeen glass-industry companies operating factories throughout Australia. The organisation has four companies engaged in materials supply, including refractories; five companies with nine establishments in glass-products manufacture; one company making electric filament lamps; one company trading as an importer of glass fibres and fibre products; and six more companies operating fourteen establishments in associated activities to glass-products manufacture—engineering services, closures of plastics and metal including wads, fibreboard containers, wooden cases and crates—those companies also making products for other manufacturers as a normal service. A.C.I. Ltd. is associated with the principal safety-glass manufacturer in Australia (and the only company using the toughening process). A.C.I. Ltd. also has subsidiary companies engaged in manufacture of bright-steel bar and bright-steel bolts and nuts; forged tools such as axes, sledgehammers, picks, etc.; products fabricated from structural and plate steel; paper-based and textiles-based industrial and decorative plastics laminates; and ceramic wall-tiles. A subsidiary company is operated for the insurance requirements of the group; and, mainly through a subsidiary company for investments, a considerable aggregate shareholding is held in certain companies in other industries, including paper-making, hardboard manufacture, chemicals manufacture.

Glass Containers (Bottles, Jars, Flasks) and Tubing: In 1949-50 and 1948-49 there were 7 establishments. In 1948-49 2 each employed from 21 to 50 persons, 2 each from 51 to 100 persons, and 3 each more than 100 persons. The five largest establishments employed 2,396 persons out of the activity total of 2,486 persons. Australian Consolidated Industries Ltd. owns through two subsidiary companies the five largest establishments, at one of which tubing for all industrial and scientific uses, and ampoules, are also made; establishments of associated companies providing engineering services, closures of plastics and metal, and fibreboard containers are located adjacent to one or more of the glass-container plants. A food-products manufacturer operates a glass-container plant for its own requirements, and another company operates a small plant making only containers for sale. In 1951 a small factory making minor glass items began making a limited range of bottles.

Sheet Glass (Plain Clear, Heavy-drawn, Fire-polished Plate, Figured Rolled, Cast Wired) and Glass Bricks, Blocks and Tiles: One establishment, operated by Australian Window Glass Co. Pty. Ltd., Sydney, N.S.W., a wholly-owned subsidiary company of A.C.I. Ltd.

Plain and Decorative Pressed and Blown Glassware, including Lighting-ware, Domestic and Industrial Heat-resistant Ware, Scientific, Industrial and Commercial Flint-blown, Cut Lead-crystal and Stemware: About 25 establishments. Two establishments produce the greater part of Australian output of products listed above—Crown Crystal Glass Pty. Ltd., Sydney, N.S.W., making glassware generally (and operating a printing plant in service to the A.C.I. organisation), and Dott and Co. Pty. Ltd., Melbourne, Vic., both wholly-owned subsidiary companies of A.C.I. Ltd. The other manufacturers are small companies or businesses, each with one establishment and mainly concerned with either scientific and industrial flint-blown, or with decorative ware.

Glass Components for Electric Lamps, Radio and Other Electronic Valves: Mainly produced at one establishment, operated by Newcastle Glass Works Pty. Ltd., Newcastle, N.S.W., a company owned in conjunction by the principal manufacturer in Australia of filament lamps and only manufacturer of hot-cathode fluorescent lamps, Electric Lamp Manufacturers (Australia) Pty. Ltd., Newcastle, N.S.W., and the principal manufacturer in Australia of electronic valves, Amalgamated Wireless Valve Co. Pty. Ltd., Sydney, N.S.W. Glassware for filament lamps is also made in the A.C.I. Ltd. organisation to supply a small electric-lamp factory operated by Australian Incandescent Co. Pty. Ltd., Sydney, N.S.W., a wholly-owned subsidiary company of A.C.I. Ltd.

Safety Glass: Two companies only. Pilkington Bros. (Aust.) Pty. Ltd., with an establishment at Adelaide, S.A., and at Geelong, Vic., makes only safety glass, toughened ("Armourplate") and laminated; the company is owned by Pilkington Bros., U.K., and A.C.I. Ltd. The other company, Melbourne Glass Beveling and Silvering Co. Pty. Ltd., Melbourne, Vic., makes the laminated form and is principally a glass fabricator.

Fabricating and Otherwise Processing of Sheet Glass and Plate Glass—Beveling, Silvering, Bending, Sandblasting, Leadlighting, Glazing: About 100 establishments, some of which also engage in shopfitting as an incidental activity. Not included in this group in official statistics are glass fabricators, etc., which are mainly concerned with shop fitting (included with joinery), nor jobbing glaziers and similar businesses not using power and employing less than four persons, which are not recorded as factories.

CEMENT PRODUCTS (other than Asbestos-cement Products): In 1949-50 there were 425 establishments and in 1948-49 357 establishments wholly or mainly engaged in this activity. Of the 1948-49 establishments, 284 each employed up to 10 persons, 41 each from 11 to 20 persons, 24 each from 21 to 50 persons, 5 each from 51 to 100 persons, and 3 each more than 100 persons. Of the total of 3,483 persons, the not-more-than-20 group employed 1,911 persons.

Wet Concrete, Ready Mixed: About ten establishments, one manufacturer, Ready Mixed Concrete Ltd., operating seven mixing plants at four capital cities.

Foamed Concrete: Several manufacturers.

Dry-mixed Concrete: Several manufacturers.

Concrete Pipes and Conduit: About forty-five establishments, of which twenty-nine are operated by one company, Humes Ltd., (also engaged in manufacture of steel pipes), ten by a second company, Rocla Pipes Ltd., and three by another company, Monier Pipe Co. Pty. Ltd.

Concrete Building Bricks and Blocks. Cement Roofing. Wall and Floor Tiles: About 250 manufacturers.

Concrete Posts, Beams, Lintels, Plinths, Poles, Panels, Piling and so on: About thirty establishments. Manufacture of these products is undertaken in association with other concrete products.

Concrete Walls and Floorings: Several establishments, in particular that operated by the Housing Commission, State of Victoria.

Cinder Concrete Building Bricks and Blocks: Three major manufacturers, each operating one establishment.

Builders' Concrete Products—Wash-tubs, Cisterns, Basins, Grease Traps and so on: About twenty manufacturers.

ASBESTOS-CEMENT PRODUCTS (Sheets, Pipes, Spouting, Mouldings, etc.): Thirteen establishments wholly or mainly engaged in 1948-49 (14 in 1949-50), of which eight each employed more than 100 persons, collectively employing 1,839 persons out of an industry total of 1,969 persons. Five of the thirteen establishments are operated by a specialist company, James Hardie Asbestos Co. Ltd. (with associate companies in other industries); three by a manufacturer, Wunderlich Ltd., also making terra-cotta tiles and metal building components; one by a cement maker, and one by a company, Colonial Sugar Refining Co. Ltd., engaged in sugar milling and refining, gypsum and asbestos mining, chemicals manufacture, and building-materials manufacture—plaster of Paris, fibrous-plaster products, gypsum wallboard, hardboard, softboard (from bagasse), and asbestos-base floor-tiles (also called "asphalt" floor-tiles).

FIBROUS-PLASTER WALL AND CEILING BOARDS, AND MOULDINGS: In 1949-50 there were 355 establishments, and in 1948-49 338 establishments wholly or mainly engaged in this activity. It is probable that a substantial number of small producers were not recorded as factory establishments because power was not used and less than four persons were regularly employed. Of the 1948-49 establishments, 256 each employed up to 10 persons, 56 each from 11 to 20 persons, 21 each from 21 to 50 persons, 4 each from 51 to 100 persons, and 1 employed 103 persons. Of the 3,144 persons engaged in the 338 establishments, 2,205 were in the not-more-than-20 group.

OTHER NON-METALLIC PRODUCTS: Other products of non-metallic mineral origin are listed below, with, where known, the number or the approximate number of establishments in each field. In 1948-49 there were 45 establishments engaged wholly or mainly in one or more of the activities. Twenty-eight of these establishments each employed up to 10 persons, 10 each employed from 11 to 20 persons, 4 each from 21 to 50 persons, and 3 each from 51 to 100 persons. Of the 630 persons employed in the 45 establishments, 276 were in the not-more-than-20 group.

Coated Abrasives: Three manufacturers. One small company makes glasspapers only. One other small company makes glasspapers and emery cloths and tapes. The third company, Behr-Manning (Australia) Pty. Ltd., (a subsidiary of a U.S.A. company, which is one of the largest manufacturers of coated abrasives in the world) has an establishment at present engaged in cutting, etc., of imported rolls of garnet, aluminous-oxide and silicon-carbide coated papers and cloths into coils, sheets, discs, cones, belts, and so on. This company is now equipping its establishment for abrasive-coating of paper and cloth. It is already engaged in adhesive-coating of imported paper and regenerated cellulose film for pressure-sensitive masking and sealing tapes.

Bonded Abrasives—Wheels, Segments, Stones, Hones, Sticks, Mounted Points, etc.—and Abrasive Powders and Pastes: About eight manufacturers. The principal manufacturer, Australian Abrasives Pty. Ltd., Sydney, N.S.W., operates one establishment, and joins Australian machinery and engineering equipment manufacturing and merchandising interests with major U.S.A. abrasive interests. Three of the manufacturers make diamond-impregnated wheels, etc. (two of which also make diamond-faced bits, diamond powder, etc.).

Steel Shot and Grit Abrasive: One manufacturer only, The Grit Co. of Australia Pty. Ltd., Melbourne, Vic.

Asbestos Products (not including Asbestos-cement Products)—Mattresses, Cords, Filter Pads, Cements, Packings, Compositions, Laggings, Shaped Blocks, Gaskets, Stovemats, Tubes, and so on: Three major manufacturers, two of which specialise in asbestos products; the third is the only manufacturer of asbestos-base brake linings and clutch facings, shaped blocks, 85 per cent. magnesia, and is also engaged to a major extent in the production of asbestos-cement sheets and mouldings.

Graphite Milling and Treatment—Foundry and Furnace Facings, Lubricant Graphite: About ten manufacturers.

Graphite Crucibles and Foundry Accessories—Base Blocks, Spouts, Pre-heater Rings, Tundishes, Stoppers, Nozzles and so on: Two manufacturers. One company specialises, Morgan Crucible (Aust.)

Pty. Ltd., Sydney, N.S.W., a branch of a leading United Kingdom graphite-products company. The other company, Newbold General Refractories Ltd., N.S.W., is the leading manufacturer in Australia of clay and non-clay refractories.

Carbon Block (Soft Grade only): One manufacturer, H. R. Hills and Sons Pty. Ltd., Melbourne, Vic., making carbon brushes (and also sintered bearings).

Gypsum Wallboard: Two manufacturers. (See Plaster of Paris manufacture, earlier in this Part.)

Mica Products—Condenser Plates and Films; Micanite Sheet (heat resistant), Commutator, Moulding and Flexible Grades; Moulded Section: Three major manufacturers. In addition there are several firms which engage in the cutting of mica as a minor phase of their other activities.

Mineral-earths Milling and Processing—Talc, Clays, Kaolin, Silica, Limestone, Feldspar, Barytes, Calcium Carbonate, Fluorspar, Pigment Minerals, and so on: About twelve companies are engaged in this field; three establishments are operated by one company.

Mineral Wool and Mineral-wool Products—Granules, Batts, Blankets, Mattresses, Blocks, Cements, Acoustic Panels, and so on: Two companies. One company, Bradford Insulation Pty. Ltd., operates five plants (one in each of three States, and two in one State), and uses blast-furnace slag at each plant. The other company, Insulwool Products Pty. Ltd., a subsidiary company of the principal producer of plaster of Paris, has one plant in each of two States, and uses a limestone/silica/basalt mixture for raw material. Plant locations, both companies, are Brisbane, Qld.; Newcastle, N.S.W.; two at Sydney, N.S.W.; Melbourne, Vic.; Adelaide, S.A.; and Perth, W.A.

Plaster of Paris Figures and Models: Several manufacturers.

Clay Models and Commercial Sculpturing: About ten manufacturers.

Sand/lime Building Bricks: Two manufacturers.

Part Two: Outline of Capacity of Manufacturing Activities

THIS description of industries based on non-metallic minerals is divided into the major categories of processing activities. Preceding the description, information as to availability of raw non-metallic materials is provided. A considerable part of the material in this section on raw materials, and most of the statistics (which relate mainly to calendar years) have been provided by the Bureau of Mineral Resources, Geology and Geophysics, of the Department of National Development. Specific enquiries concerning mineral resources should be addressed to the Bureau.

AVAILABILITY OF RAW MATERIALS

Arsenic

Arsenical minerals (principally arsenopyrite) are present in metalliferous deposits in all the States of Australia. The principal sources are in south-eastern Queensland and north-eastern New South Wales, where the arsenical minerals are associated with tin and copper deposits, and at widely separated goldmining localities in Western Australia. The greater part of the Australian production was as a by-product in the treatment of gold ores by Wiluna Gold Mines, Wiluna, W.A. The only present producer is the metallurgical works of A. Victor Leggo & Co. Pty. Ltd. at Bendigo, Vic., where production will apparently be maintained at the rate of about 250 tons a year (arsenic trioxide 99.5 per cent. purity).

Supplies from all sources are insufficient to meet demand, which is estimated at about 2,500 tons a year. Consumption (by virtue of its toxicity) is almost entirely in the manufacture of insecticides, fungicides, weedicides, rodenticides, etc. Future possibilities for increased production are problematical.

Andalusite (see Sillimanite)

Arsenopyrite (see Arsenic)

Asbestos

The bulk of Australia's asbestos requirements is imported from Southern Rhodesia, South Africa and Canada, and in 1948-49 and 1949-50 amounted to 14,777 tons and 29,034 tons. This was almost entirely of the short white asbestos, Chrysotile, with smaller amounts respectively of Amosite, etc., acceptable for blending with it for use in the manufacturing of asbestos-cement sheet and pipe which absorbs some 90 per cent. of the total consumed. Of the 1,600 tons produced in Australia, in 1950 two-thirds was the blue asbestos, Crocidolite. Exports amounting to a few hundred tons a year of the "long" blue asbestos to U.K. and U.S.A. have been mostly in exchange for equivalent quantities of "short" white fibre.

Asbestos has been found in each of the States of the Commonwealth, but the only considerable occurrence of economic importance is at Hamersley Ranges, W.A. The asbestos there is the blue asbestos, Crocidolite, and is mined by an associate company of Colonial Sugar Refining Co. Ltd., one of the largest users of asbestos in Australia. The principal producers of white asbestos, Chrysotile, are located at Baryulgul, N.S.W., and Nunyerry, W.A.

Production, exports and imports of asbestos over the years 1947 to 1950 were as follows—

PRODUCTION:	1947	1948	1949	1950
	tons	tons	tons	tons
Chrysotile	340	356	362	585
Crocidolite	928	647	1,173	1,031
Anthrophyllite	75	284	—	—
Amphibole (other)	35	40	59	1
Totals	1,378	1,327	1,645	1,617

CONSUMPTION:	1947	1948	1949	1950
	tons	tons	tons	tons
Australian production	1,378	1,327	1,645	1,617
Exports (crude and fibre)	652	278	346	385
Remaining in Australia	726	1,049	1,299	1,232
Imports	14,247	14,888	14,777	29,034
Apparent consumption	14,973	15,937	16,076	30,266

Imports in 1949 to the value of £859,565 were from hard-currency areas (North America), and to the value of £885,695 from soft-currency areas. Exports were to Belgium, £2,187, and to the U.S.A., £17,465.

Barite

Considerable deposits of barite exist in New South Wales, though most of the reserves are fairly low grade. Appreciable deposits of high-grade material occur in South Australia (Flinders Range area). Production is confined to the above two States, though recently mining has commenced in Western Australia. Current production is nearly 6,000 tons a year. Ground barite is mostly exported for oil-drilling purposes. Were a lithopone factory to be established in Australia an additional 2,700 tons of barite would be necessary to satisfy the requirements.

Bauxite (see also Aluminium, Chapter 9)

Present production of this mineral is small, its use being confined to either a slag corrector in the steel industry (mostly from N.S.W.) or to the manufacture of such chemicals (nearly all Victorian production) as alum and aluminium sulphate, both for use in paper-making and water-filtration purposes. Deposits are fairly widespread, and estimated reserves of all economic deposits aggregate some 20 million tons. A recent discovery in Northern Territory will increase the reserves. When production of aluminium ingot is firmly established in Australia, there will probably be a considerable increase in bauxite production. Production was as follows—

PRODUCTION:	1947	1948	1949	1950
	tons	tons	tons	tons
New South Wales	2,363	2,871	1,264	1,155
Victoria	2,515	2,774	4,028	2,312
Totals	4,878	5,645	5,292	3,467

There were no imports, and the only exports were to New Zealand—151 tons, 134 tons and 176 tons in 1947, 1948 and 1949 respectively.

Bentonite

There are three main bentonitic clay deposits in Australia that appear to be worth developing. They are, in order of importance, at Yarriman, Qld.; Marchagee, W.A.; and Trida, N.S.W. Although the tonnage mined is quite considerable, the Australian material is generally strengthened by the inclusion of some American (Wyoming) bentonite. Some bentonite of slightly higher grade than the Australian, is imported from New Zealand, while American bentonite is recognised as superior to any in Australia and possesses considerably more bonding strength. Bentonite is absorbed mainly by the foundry industry (about 90 per cent. of the total quantity) as a bonding agent for foundry moulding sand. Other uses include wine and fruit-juice refining, sealing compounds, welding electrodes, porcelain enamels.

Production, imports and apparent consumption were as follows—

PRODUCTION:	1947	1948	1949	1950
	tons	tons	tons	tons
Queensland	160	70	85	50
Western Australia . .	45	269	150	213
Totals	205	339	235	263
CONSUMPTION:	1947	1948	1949	1950
	tons	tons	tons	tons
Australian production .	205	339	235	263
Imports	1,109	1,359	1,821	1,482
Apparent consumption	1,314	1,698	2,056	1,745

Bentonite imports in 1949 were valued at £16,756 in hard currency, but owing to lack of suitable material it is not possible to make good this deficiency from local sources. Relief may be afforded by an improvement in quality and quantity of New Zealand supplies.

Clays (including Kaolin)

Statistical information on the demand for clays in Australia is incomplete, but it is estimated that the total requirements for all types would exceed 3 million tons a year. A large percentage of this would be used in the manufacture of bricks and cement. The only available production data for 1949 are as follows—

PRODUCTION:	Pottery Kaolin	Fire-clay	Brick and Tile Clay	Cement Clay
	tons	tons	tons	'000 tons
Queensland	59	24	(a)	(a)
New South Wales . . .	15,670	35,764	44,843	1,103
Victoria	3,195	4,818	(a)	(a)
Tasmania	7,316	(a)	(a)	(a)
South Australia . . .		40,985	(not itemised)	
Western Australia . .	80	4,131	5,475	(a)

(a) Not recorded.

(b) Clay shale.

It is known that there are in Australia large resources of clay suitable for manufacture of most types of clay products and that suitable economic deposits are located at or near all principal centres of demand. At Melbourne, Sydney, Adelaide and Hobart, clays of the non-plastic type predominate as the raw material for bricks and tiles. At Brisbane, Perth and Launceston, and at most inland centres clays of the plastic type are more frequently utilised for bricks and tiles. No good ball clays are known in Australia.

Fireclay is obtainable at no great distance from consuming centres, and highly aluminous types are obtained at Galgony, Banabra, Bur-

gonia and Jervis Bay in New South Wales, at Lal Lal in Victoria, at Williamstown in South Australia, and at various places within 50 miles of Perth, Western Australia. Many of these are white or white-burning clays, and can be used in body mixtures as well as for fillers.

Filler clays are readily obtainable, but paper and other surfacing clays are in short supply. About 1,300 tons of ball clay, china clay, fireclay and other types are imported each year. Research into the beneficiation of clays and their utilisation on various products is being carried out by the C.S.I.R.O., and could lead to an increased demand for certain types of clay.

Chromite

Small deposits have been worked in New South Wales and Queensland. New South Wales, now a non-producer, has some reserves of low-grade (30-35 per cent. chromium oxide). Queensland, the only producing State, has some reserves (30-35 per cent. chromium oxide). In Western Australia a group of deposits in the Coobina area is believed to contain large reserves of ore (about 45 per cent. chromium oxide) suitable for chemical and refractory requirements (latest estimates suggest at least 200,000 tons), but the locality is isolated and the cost of production will be high.

Total Australian production for 1949 (from Rockhampton district, Queensland) was 632 tons, compared with 555 tons in 1948. The whole of this material (about 33 per cent. chromium oxide) was used by Newbold's General Refractories Ltd., N.S.W., and Mount Isa Mines Ltd., Qld., in the manufacture of refractory bricks.

Australian normal requirements are estimated as follows: Refractory grade, 2,000 tons; chemical grade, 1,350 tons; and metallurgical grade, 700 tons. In addition, certain portions of the metallurgical requirements are satisfied by importation of additional quantities of ferro chromium.

Broken Hill Pty. Co. Ltd., the only manufacturer of ferro chromium (also one of the principal consumers of refractory-grade ore), imported no chromite in 1949, but drew on stockpiled material for their requirements. Production of ferro chromium at its Newcastle works in 1948 and 1949 was 470 tons and 590 tons respectively.

Diatomite

Occurrences of diatomite are widespread, substantial deposits being known in New South Wales, Victoria, Western Australia and Queensland. Reserves of diatomite of freshwater origin (Melosira) and marine origin (Synedra) are considerable, but for some specific purposes appear to have limitations, particularly as a true filter medium, which accounts for most importations. Apparent consumption over the years 1947 to 1950 was as follows—

CONSUMPTION:	1947	1948	1949	1950
	tons	tons	tons	tons
Australian production .	5,543	4,438	4,063	6,221
Imports	1,495	571	1,275	1,652
Exports	168	144	85	137
Apparent consumption	6,870	4,868	5,253	7,736

Diatomite imports are practically all from California, U.S.A., and in 1949 were valued at £22,360.

Consumption of diatomite is estimated at 5,500 tons a year. About 80 per cent. is from domestic resources, of grades quite suitable for thermal insulation, insecticide manufacture, rubber reclamation, abrasives, fillers, and as filter aids in chemical manufacture, sugar clarification, etc. Imported material is of the refined or "activated" type (diatomaceous earth), which is used in conjunction with Australian diatomaceous earth for special clarification (e.g., reclamation of dry-cleaners' white spirit) and potable water filtration (see Diatomaceous Earth). Estimated consumption is about as follows: As a filter aid, 1,000 tons; as a filter medium (manufactured earth), 1,800 tons; heat insulation, 2,000 tons; and abrasives, fillers, 700 tons.

The limiting factor on future demand for the Australian mineral is largely the extent to which Australian manufacturers of diatomaceous earth can adapt it, by blending of the various deposits and developing treatment technique, for specific filtration purposes.

Dolomite

Deposits of dolomite in Australia are considerable and adequate to meet both Australian and export needs for a long period. Present production and consumption of some 45,000 tons a year (1950 production, 74,611 tons) is mainly located in New South Wales where the iron and steel industry is principally situated. Other producing States are Queensland (producing some 12 per cent.) and South Australia (with about 6 per cent. of the total). The South Australian quota has increased since 1948-49 now that the iron and steel works in New South Wales are securing much of their dolomite requirements from Ardrossan, S.A. Western Australian deposits supply that State's needs. Small quantities of dolomite are absorbed in the various States in the manufacture of glass, fertiliser, mineral wool, and as a neutraliser for acid effluents. Exclusive of the production figures mentioned, unknown but substantial quantities are quarried for roadmaking, principally in the States of Tasmania and Western Australia. Importations of dolomite are nil, and exports were a wartime measure only.

Normal apparent consumption of dolomite is at present about 45,000 tons a year, used for: Refractories, 38,000 tons; fertiliser, 2,500 tons; glass manufacture, 2,000 tons; and miscellaneous, 2,500 tons.

Fullers' Earth

Fullers' earth production in 1950 was 40 tons (from Dubbo, N.S.W.). Imports of special grades from the United Kingdom (598 tons) and exports (131 tons) indicate an apparent consumption of about 400 tons yearly, for which the material of Australian origin is not always satisfactory. Fullers' earth is used largely in the reclamation of waste-lubricating oils (low-quality satisfactory), clarification of vegetable oils, grease and lard, and in cosmetic manufacture, and as a filler.

Felspar

Australian reserves of felspar suitable for all purposes are considerable. At Londonderry (near Coolgardie), W.A., reserves of potash felspar are estimated at 55,000 tons, whilst at Gumeracha (Olary district), S.A., deposits of both the soda and potash felspars are estimated at 300,000 tons. Large deposits of potash also exist in the Broken Hill area, N.S.W. (the principal producing area in Australia),

and soda felspar is obtained from deposits at Wog Mountain, N.S.W. Two of the principal mining companies (one at Gumeracha, and one at Londonderry) are associate companies of the largest consumer, Australian Consolidated Industries Ltd. Australian demand for felspar (all grades) is estimated at about 10,600 tons a year, and consumption is of the following order: Glass, 9,000 tons; pottery, glazes and enamels, 2,600 tons; abrasives, 1,100 tons; and miscellaneous (mostly welding electrodes), 150 tons.

Felspar for abrasives is usually obtained from the Broken Hill area, whilst that for pottery and ceramic uses comes from both the Broken Hill and Olary districts. This material is frequently prepared and distributed by the mineral-earth millers.

Current production, about 13,000 tons, is sufficient for demand. Exports, which are growing in importance (principally to Singapore), amounted to 388 tons in 1950. Imports were 273 tons.

Fluorspar

Apparent and estimated actual consumption of fluorspar over the years 1947 to 1950 were as follows—

CONSUMPTION:	1947	1948	1949	1950
	tons	tons	tons	tons
Australian production	1,200	511	562	576
Imports	—	42	70	409
Exports	—	—	—	—
Apparent consumption	1,200	553	632	985
Estimated actual consumption	1,350	1,350	1,200	1,400

Queensland (Mungana-Chillagoe area) normally produces 80 per cent. of Australian production, and Victoria (Pine Mountain area) normally the other 20 per cent., but is not now producing. The quality (85-90 per cent.) was only suitable for metallurgical requirements, so that, irrespective of possible quantitative increase, Australian demands for ceramic and acid grades will have to be met by importations.

Estimated consumption by grades and uses for 1947 and 1948 was as follows—

CONSUMPTION:	1947	1948
	tons	tons
Industries—		
Foundries and steel (flux)	470	490
Glass (for opaque glass)	410	350
Enamels	430	450
Acid manufacture	40	60
Grades—		
Acid (98%)	40	60
Ceramic (90-95%)	430	450
Metallurgical	880	880

Due to supply difficulties, glass manufacturers are using metallurgical grades, the ceramic industry is also using some of this quality, and in the steel industry gradings as low as 70 per cent. are being utilised. Acid manufacturers are depending on imports from the United Kingdom, Germany and France. Potential requirements once the aluminium and (later) the tinplate industries are established (see Chapter 9) will increase to about 4,000 tons a year of the following grades: Acid grade, 1,600 tons; ceramic grade, 550 tons; and metallurgical grade, 1,850 tons. Reserves of fluorspar are adequate to meet this demand, but this will necessitate either considerable improvement in beneficiation technique or recovery from the tailings from the treatment plants at Broken Hill. An obvious opportunity exists for enterprise in this direction.

Gem Stones

A variety of gem stones is found in Australia. The principal commercial stones are opal (production in 1949 was valued at £42,590, 95 per cent. obtained from South Australia); sapphire (production in 1949 was valued at £4,873, nearly all from Queensland). Small amounts of industrial diamonds are produced in New South Wales. No deposits of emeralds or rubies are known.

Glauconite

At Gin Gin, W.A., appreciable occurrences of greensand (carrying up to 40 per cent. glauconite) are known. Production, which is adequate for demand leaving a surplus for export, is as follows—

PRODUCTION:	1947	1948	1949	1950
	tons	tons	tons	tons
Greensand treated	1,753	1,595	1,018	1,617
Glauconite obtained . . .	351	319	204	323

Granite (see Stone for Building, etc.)

Graphite

Australian deposits from which graphite has been or is being produced are at Collinsville, Qld., Undercliffe Mountain, N.S.W., and in the Port Lincoln district, S.A. Others of possible economic importance are in the Munglun and Kendenup districts, W.A. Total reserves are not known, but may be large enough to satisfy about 85 per cent. of Australian requirements for many years. Present production is of less than 70 per cent. carbon quality. The remaining 15 per cent. is for crucible and special grades at present unknown in this country. Australian requirements of high grades (70 per cent. or more carbon) are at present imported from Ceylon and Madagascar. Estimated requirements amount to about 1,100 tons a year in the following grades: Less than 70 per cent. carbon, 160 tons; 70-90 per cent. carbon, 840 tons; and more than 90 per cent. carbon, 140 tons. Apparent consumption over the years 1947 to 1950 was as follows—

CONSUMPTION:	1947	1948	1949	1950
	tons	tons	tons	tons
Australian production (all qualities)	303	231	124	145
Imports (all qualities)	593	1,162	717	807
Exports (all qualities)	47	81	38	91
Apparent consumption	849	1,312	804	861

Consumption by uses at 1950 was approximately as follows: Dry-battery manufacture, 430 tons; iron and steel manufacture, 215 tons; stove polish, 107 tons; and miscellaneous uses, 107 tons.

Gypsum

Australia has very large reserves of high-grade gypsum in four States, but most deposits have not been economically exploited, either due to problems of overburden or more usually to remoteness from either consumers or economic transportation. The largest production comes from one deposit in South Australia, at Lake Macdonnell; reserves there are estimated at 765 million tons. The Lake Macdonnell deposit has very little overburden, is close to the sea (permitting sea transport) and is operated by a company group which is the largest manufacturer of plaster of Paris in Australia and also making plaster products. Considerable development is being undertaken of Lake Macdonnell deposits including the erection of a new plaster factory at Ceduna, the laying of a spur-railway line to the de-

posits, and the erection of a bulk-handling jetty and deep water facilities.

Production and apparent consumption over the years 1947 to 1950 were as follows—

PRODUCTION:	1947	1948	1949	1950
	tons	tons	tons	tons
New South Wales	65,301	74,114	82,653	102,204
Victoria	22,895	29,298	30,985	39,945
South Australia	106,955	147,482	147,698	156,031
Western Australia	20,284	25,522	25,907	35,210
Totals	215,435	276,416	287,243	333,390

CONSUMPTION:	1947	1948	1949	1950
	tons	tons	tons	tons
Australian production	215,435	276,416	287,243	333,390
Imports	7	6	7	132
Exports	27,985	35,164	37,254	27,131
Apparent consumption	187,457	241,258	243,996	306,391

Consumption by uses at 1950 was about as follows: Plaster of Paris, 248,200 tons; cement, 55,150 tons; and miscellaneous uses, 3,050 tons.

Ilmenite (see Zircon-Rutile-Ilmenite)

Kyanite (see Sillimanite)

Limestone

Calcareous materials in economic qualities in the form of either limestone, marl, coral, marble, occur in many localities in all States, and in amounts adequate for all present and foreseeable requirements. Annual production, which is steadily increasing, is possibly 2.5 to 3 million tons a year. Estimated consumption is as follows: Cement making, 1,500,000 tons; metallurgical industries (principally as a flux in steel production), 600,000 tons; general chemical manufacture (principally for soda ash, calcium chloride, chromium chemicals, calcium carbide, etc.), 150,000 tons; limeburning, 200,000 tons; agricultural use (this also includes a considerable amount as waste quicklime), 200,000 tons; glass manufacture, 30,000 tons; and a further unknown but substantial amount for roadmaking. Most of the quarries of any significance are mechanised and have relatively small amounts of overburden to cope with.

Production is principally confined to the States of usage. The exception is New South Wales where the steel industry is located and requirements are mainly quarried and shipped from Rapid Bay, South Australia.

Magnesite

About 96 per cent. of magnesite production in Australia (1950, 35,910 tons) comes from New South Wales, where practically all output is used as a refractory in the iron and steel industry. Known reserves (mostly in New South Wales) are appreciable, but there and elsewhere in Australia many of the deposits are not favourable to economic exploitation.

Production of mineral wool (magnesite as flux), thermal insulation, magnesium chemicals (epsom salt, etc.), absorb most of the remaining 4 per cent. of production. In Western Australia, due to the needs of the expanding Wundowie charcoal-iron plant, production of magnesite is increasing. In South Australia, the only other producer of any consequence, production is fairly low but constant. Imports and exports are negligible.

Mica (Muscovite, Phlogopite) and Vermiculite

Australian deposits of MICA (muscovite) are unproven, but appear numerous, small and erratic. Remoteness and unfavourable climatic

conditions discourage full exploitation. Muscovite is secured in Northern Territory and Western Australia. Production in 1950 was 74,070 lbs. of block. Exports (micanite) were 42,000 lbs. (valued at £42,000, to New Zealand). Imports, practically all from India, were 357,395 lbs., of which 138,770 lbs. were splittings, 52,665 lbs. were block, 163,960 lbs. were scrap, and 2,000 lbs. were dust.

VERMICULITE is produced only in Western Australia, where reserves appear satisfactory for present requirements. Production in the Young River district by three companies was 156 tons in 1948-49, and was adequate to local requirements for manufacture of insulating material. Exports and imports are understood to be negligible.

Mineral Pigments

Production of mineral pigments is not a stabilised industry in Australia because of economic and quality limitations of indigenous resources. It is estimated that Australian requirements amount to about 4,000 tons, of which nearly 50 per cent. is met from Australian production, the remainder being imported from the United Kingdom (about 37 per cent.), and Spain (20 per cent.). Australian production, 1950, of 1,772 tons was derived from New South Wales (50 per cent., yellow and red); Western Australia (22 per cent., yellow and red) and Northern Territory (20 per cent., yellow only).

Potash

Deposits of commercial value are few. A small deposit exists at Bullahdelah, New South Wales (average 37-39 per cent. alunite) where regular quantities are mined by underground methods for use in the manufacture of potash alum by Sulphates Ltd., Melbourne, Vic. (1950 production, 397 tons). A large deposit of alunitic mud occurs at Lake Campion, W.A., in which State several other small deposits are known. The reserves at Lake Campion are estimated at 12 million tons with an average content of 60 per cent. alunite; it is considered that 20 million tons of potash and 1.5 million tons of alumina could be recovered. It is not considered as a practical source of alumina supply (for aluminium manufacture), but efforts have been made by a Western Australian Government authority to recover the potash (production 1949, 1,450 tons). Production has been discontinued pending further investigation. The only other source of potash yet exploited is a by-product, potassium sulphate, from cement-plant flue dust at Geelong, Vic. Production was in the vicinity of 700 tons a year (80 per cent. potassium sulphate) and was absorbed as a fertiliser, but production has recently ceased. Australian requirements of potash are estimated to be about 15,000 tons a year, of which about 95 per cent. would be absorbed as a fertiliser (particularly for sugar cane); the balance would be in the form of refined potassium chemicals for industry.

Quartz

Deposits of quartz crystal (for use in frequency control in radio and telephone transmission) of commercial importance are few and only one or two have been worked. Production is haphazard and inadequate, and requirements must be met by imports. Australian production in 1950 was 600 lbs., while imports were 1,000 lbs.

Salt

Salt is produced in Australia by solar evaporation of sea water in pans and from inland salt lakes. There are no known deposits of rock salt. Established and potential salt resources are sufficient to supply existing and likely future domestic requirements and to provide a surplus for export. Established locations, and much of the potentially more economic locations, are mainly in South Australia, which is climatically and geographically well favoured for salt production from sea water.

The 1949 harvest was about 247,000 tons and the 1950 harvest about 277,000 tons. Production by States was as follows—

PRODUCTION:	1949	1950
	tons	tons
South Australia	170,000	200,000
Victoria	60,000	70,000
Queensland	11,000	nil
Western Australia	6,000	7,000
Totals	247,000	277,000

New South Wales and Tasmania are non-producers. The 1950 harvest in Queensland failed entirely because of rain. Generally about 70 per cent. of the salt harvested in Australia is solar salt and the remainder from salt lakes or pans.

Shortages of salt have occurred in the eastern States in the post-war period due to harvest limitations in some seasons, and to shortages of labour (harvesting and refinery) and transport. The industry has been unable to stockpile salt to an extent that would cope with bad harvests and simultaneously meet the rising demand from industry. Capacity has been increased by mechanisation of the harvesting operations at several works, and is being further increased by considerable extension of pan areas in South Australia and, to lesser extent, in Victoria. It is estimated that the harvest from existing leases in South Australia, with full development of areas and more intensive working, could be increased from the present 200,000 tons to 300,000 tons a year.

Newcomers are considering entering the industry, among them The Broken Hill Proprietary Co. Ltd., which produced 3,000 tons of salt in 1951 following experimental flooding of a suitable area close to its Whyalla (South Australia) iron works and shipbuilding yard.

Nearly half the crude salt production now goes straight into chemical manufacture. The yield from the I.C.I. pans at Dry Creek, S.A., is entirely used at the nearby soda-alkali works of Imperial Chemical Industries of Australia and New Zealand. Capacity is being further extended. The yield of lakes harvested in Victoria by I.C.I. is also for chemical production—caustic soda, chlorine, ammonium chloride.

From 50 to 55 per cent. of the total salt harvested in Australia passes through salt-refining establishments, including some crude salt not processed, but sold as such from the refinery. For details, see "Salt Washing, Crushing, Grading," later this Part, where exports and imports of salt in various grades and details of consumption in Australia are stated.

At the saltworks at Geelong, Vic., small quantities of magnesium sulphate, magnesium chloride and carnallite are produced from portion of the bitterns. Magnesium salts generally and in quantity, and bromine and deriva-

tives, are not produced from bitterns in Australia, although the quantity of bitterns available is adequate for Australia's present requirements of those chemicals. Requirements in Australia for bromine and its derivatives are about 100 tons a year at present, and of magnesium salts about 500 tons a year.

Sandstone

A sandstone suitable for grinding wheels, millstones and similar uses is quarried in Queensland and Tasmania. Adequate supplies are available for all purposes.

Silica

In its different forms (e.g., sand, quartz, sandstone, quartzite, etc.) silica is widespread throughout Australia and is usually obtainable without difficulty. Silica production by mineral-earths processors (see Mineral Earths Treatment, later) was 55,156 tons in 1950 valued at £43,729.

Sillimanite, Kyanite, Andalusite

SILLIMANITE reserves in Australia are appreciable. Two of the three principal deposits (at Thackaringa, near Broken Hill, N.S.W., and at Williamstown and Olary, S.A.) are mined. Production over the years 1947 to 1950 was as follows—

PRODUCTION:	1947	1948	1949	1950
	tons	tons	tons	tons
New South Wales	118	510	552	878
South Australia	265	184	409	703
Totals	383	694	961	1,581

Australian demand for sillimanite is estimated at about 1,200 tons a year. At present, production is less than requirements. Normally importations from India make good the deficit, but transport and other difficulties have interfered with these imports. The major producer in South Australia (at Mt. Crawford, Williamstown area) produces sillimanite as a by-product of dickite (a refractory clay). Future production of sillimanite from this source is therefore contingent on a stable market being maintained for the dickite. About 90 per cent. of the consumption of sillimanite is for high-temperature refractory bricks, and the remainder for chemical and electrical porcelain, spark plug insulators, etc.

KYANITE deposits have been known and worked, but the principal source of past production (at Yanmah) is now exhausted. Demand is estimated at about 300 tons a year, but supplies from all sources (imported or otherwise) are inadequate for the refractory industry, which is the only consumer.

ANDALUSITE deposits are small, uneconomic and now not worked.

Slate (see Stone for Building Construction, etc.)

Stone for Building and Monumental Construction, Roads, Paths, etc.

Limestone, dolomite, basalt, granite, slate, marble, quartz, sandstone, gabbro, suitable for general building and roadmaking are usually available in one or more of the types desired, in reasonable proximity to their usage point, this usually being the determining factor in the selection. CORALLINE LIMESTONE from Mount Gambier, S.A., is utilised in southern Victoria and South Australia for house building, and in Queensland, New South Wales and Western Australia indigenous limestone and sandstone are being quarried for similar purposes. GRANITES, BASALTS, etc., suitable for monumental work and building exist,

though exploitation is hindered due to labour shortages and curtailment of public building construction. Australian MARBLES are, as a rule, too soft for general building (though suitable in many cases for mural work); for this reason marble chips are usually imported for terrazzo work. Stone suitable for aggregate purposes in close proximity to centres of consumption is in many cases difficult to acquire, though occurrences of roadmaking material are much more accessible and widespread. Australian SLATE suitable for house roofing is unavailable, but South Australian slate suitable for electrical switchboard panels, urinal and laboratory slates is, subject to transport and manpower, in fair supply.

Talc, Steatite and Pyrophyllite

Production for 1950 was 9,047 tons (83 per cent. from South Australia). Exports were about 600 to 700 tons (to New Zealand) and imports (not separately recorded) were probably small and principally for high-grade cosmetics. Production and usage are as follows—

TALC, about 80 per cent. (nearly all consumed by the cosmetic and rubber trades, principally the former).

STEATITE, about 7 per cent. (used as block talc for furnace refractories, also as a filler in the paint trade and in bituminous coating compounds).

PYROPHYLLITE, about 13 per cent. for miscellaneous specialties. This is produced in N.S.W. only.

The talc reserves in the Flinders Range area, South Australia, are considerable and adequate for all purposes. Recently the talc has been proven as satisfactory for the cosmetic trade, which hitherto had shown preference for imported Italian material. Treated talc is now exported. New Zealand is purchasing some 600-700 tons a year.

Vermiculite (see Mica)

Zircon, Rutile, Ilmenite

Australia is the world's largest producer of ZIRCON (zirconium ore) and RUTILE (titanium ore), but production of ilmenite, the principal source of titanium, is very small and the ilmenite enters the residues. The presence of chromium in the concentrates renders them unfit for pigment manufacture (titanium oxide). Numerous deposits in the form of heavy beach sands (containing zircon-rutile-ilmenite) occur along the east coast of Australia, from Coff's Harbour to Tin Can Bay, Queensland and contain appreciable reserves. Production by a number of operators is well established, and in 1949 was as follows—

PRODUCTION:	Zircon-Rutile-Ilmenite	Zircon-Rutile	Rutile	Zircon	Rutile Content	Zircon Content
	tons	tons	tons	tons	tons	tons
New South Wales	70	4,153	7,348	11,678	8,565	14,164
Queensland	—	—	5,068	6,265	4,863	6,115
Totals	70	4,153	12,416	17,943	13,428	20,279

In addition, about 72 tons of ILMENITE were produced in Western Australia—chrome content was only 0.03 to 0.04 per cent. This may be a suitable material for titanium-white pigment manufacture by the only manufacturer of titanium white in Australia. The company concerned is investigating the possibilities of Tasmanian ilmenite deposits (its factory is located in Tasmania). At present all ilmenite

for titanium pigments is imported from Travancore, India. Average annual usage is about 4,000 tons a year.

Zircon requirements in Australia amount to about 700 tons a year. Nearly all of this is

absorbed for two purposes—as a toughener and opacifier in ceramic enamels, glazes and glasses, and, due to its high resistance to high temperatures and low coefficient of expansion, in foundry sands for steel castings.

PROCESSING ACTIVITIES

SALT CRUSHING, WASHING, GRADING, STERILISING

The establishments engaged in crushing, washing, grading and (in five instances) sterilising of salt used, in 1948-49, 138,000 tons of crude salt; that amount is 54 per cent. of the yearly average of estimated total crude salt production for the calendar years 1948 (260,000 tons) and 1949 (247,000 tons). Crushed and washed salt for sale as such was 60,000 tons, valued at £157,150; refined salt (that is, sterilised salt) production was 60,550 tons, valued at £255,700; and 10,850 tons, valued at £25,800, was termed crude, for sale as such. In 1949-50, production increased to 63,031 tons of crushed and washed salt, valued at £178,033; 63,164 tons, valued at £274,250, of refined salt; and 13,858 tons, valued at £38,976, of crude salt, for sale as such.

Various grades of salt are produced, including coarse, refined coarse, flossy fine, household fine, free-running, butter, cheese and cooking.

Exports of salt in 1949-50 were 23,800 tons, valued at £116,210, mainly to New Zealand. 11,423 tons (£54,083) was "table salt and preparations thereof", practically all of Australian origin. The remaining 12,377 tons (£62,127) was "salt, n.e.i.", mainly crushed and washed salt for industrial processing.

Imports of salt in 1949-50 were 9,688 tons, valued at £92,219, all from the United Kingdom. The imports consisted of 5,192 tons of rock salt (£20,164), 1,585 tons of table salt (£53,312), 125 tons of dairy salt (£568), 33 tons of compressed salt block (£173), and 2,753 tons of "salt, n.e.i." (£18,002).

Established capacity in Australia for processing of crude salt to grades for market consumption is, understandably enough, closely related to harvesting capacity. Extension of harvesting capacity has been proceeding in post-war years and is continuing, in order to meet rising demand in Australia and take advantage of a promising export potential. Crushing and washing capacity for industrial grades of salt will be similarly expanded. Established capacity for sterilising of salt, to provide the "refined salt" of commerce, is not being used fully in Australia because of crude salt and labour shortages; with adequate supplies of salt and labour it can be expected that capacity for production of table and food-processing grades of salt will be fully used and probably expanded to make the most of the Australian and nearby export markets for such grades.

MONUMENTAL AND BUILDING MASONRY, TERRAZZO PRODUCTS

Established capacity in these activities is in general sufficient to meet requirements. Current output of MASONRY is well below capacity as the demand for building masonry is limited because of Governmental restrictions

on the construction of buildings other than dwellings. There is a steady but not great demand for TERRAZZO products; most of the activity by manufacturers is "on-site" work.

LIME PRODUCTS

The limeburning industry is well established in all States. In 1949-50 the industry absorbed about 262,815 tons of limestone and other calcareous materials. The major portion was converted into QUICKLIME (1949-50 production 87,501 tons) and HYDRATED LIME (1949-50 production 26,871 tons), which required a fuel consumption equivalent to about 25,000 tons of coal. In addition, large quantities of the raw material were crushed at limeburning works; that operation, with crushed spoilages and seconds from the burning operation, made available 70,415 tons of AGRICULTURAL LIME.

About 40 per cent. of Australian quicklime production in 1948-49 occurred in New South Wales, about 20 per cent. each in Queensland and Western Australia, 12 per cent. in Victoria, 5 per cent. in South Australia and 3

per cent. in Tasmania. Production of hydrated lime principally occurred in Victoria and New South Wales, in that order.

Quicklime production was absorbed in sugar making (about 12,000 tons), paper making (10,000 tons), water purification (10,000 tons), together with unrecorded amounts for agricultural use, chemicals, fellmongering, tanning, glue manufacturing, etc.

The largest consumer of hydrated lime was the building trade, and the chemicals industry, tanning, glue making and silica-brick making were other large consumers.

With both quicklime and hydrated lime the demand substantially exceeds the supply mainly because present fuel and labour shortages do not permit maximum use of plant. Plans to increase plant capacity in several States have been announced.

PLASTER OF PARIS

Capacity for manufacture of PLASTER OF PARIS is about sufficient to meet current Australian needs. Additional capacity is being provided to meet expected increased requirements. During the post-war period the supply of plaster at times was seriously short of demand because of insufficient transport for

gypsum, and fuel and labour shortages at the mills.

The quantity of gypsum used in plaster manufacture in 1949-50 was 199,764 tons. The quantity of plaster produced was 143,605 tons. About 90 per cent. of the plaster output was used in making fibrous-plaster products.

PORTLAND CEMENT

In 1948-49 the output of GREY PORTLAND CEMENT was 1,031,490 tons, valued at £4,375,650; exports were 5,263 tons (mainly to Territories and nearby Pacific Islands), and imports were 34,188 tons, £191,966 (mainly from the United Kingdom). In 1949-50 output increased to 1,167,228 tons; exports were 13,583 tons, and imports substantially increased to 114,985 tons, £678,663. In 1950-51 production increased to 1,226,595 tons. Output in the first 7 months of 1951-52 totalled 686,700 tons.

Present raw material consumption yearly by the industry is in the order of 1.7 million tons of limestones, corals, etc., 55,000 tons gypsum, 150,000 tons clay. About 400,000 tons of coal (exclusive of coal used for power generation, steam raising, etc.) and 11 million kWh of power are consumed, and about 28 million bags (multiwall paper bags) are required. Present capacity is about 1,635,000 tons a year.

Potential demand for cement is greater than present plant capacity and will become effective when restrictions on less essential construction work are eased, the supply of building labour and reinforcing steel improves, and large projected long-term building and capital works programmes are implemented. Current production of cement is close to capacity. However, considerable expansion of plant capacity is planned, and by 1953 it is expected that total annual capacity will be about 2,000,000 tons.

WHITE, COLOURED and HIGH-ALUMINA Portland cements and CIMENT FONDU are not made in Australia. Imports in 1948-49 were 1,208 tons of white, 143 tons of coloured; in 1949-50 4,462 tons of white, 1,783 tons of coloured. Import figures of high-alumina and of Ciment Fondu are not available.

CLAY BRICKS AND TILES

CLAY BUILDING BRICKS are produced largely by the press method in Australia, by a well-established industry. Production in 1948-49 was 617.4 million bricks, valued at £4,214,040, and in 1950-51 increased to 647 million. Output in the first 7 months of 1951-52 totalled 394.3 million. Actual production and production capacity (estimated) during 1949-50 by States were as follows—

Actual Production (millions)—						
N.S.W.	VIC.	Q'LD.	S.A.	W.A.	TAS.	AUST.
292	137	32	53	54	13	581
Production capacity, estimated (millions)—						
N.S.W.	VIC.	Q'LD.	S.A.	W.A.	TAS.	AUST.
450	240	50	75	75	18	908

Recently there has been a substantial reduction in building activity and as a result the supply of bricks is generally adequate to demand.

Much of the plant and equipment is old and modern methods are not employed in many plants. Improved layout of plant with a greater degree of mechanisation would permit better working conditions and require less manpower. It is considered there is scope for modern plants. There are a small number of new brickworks being established, but

although they may have an important bearing on the brick supply position in the area in which they are located they will have little effect on the overall supply position.

CLAY ROOFING TILES are almost entirely of the Marseilles pattern in Australia, and are pressed from an extruded clot of clay. Production in 1948-49 was 44.2 million tiles, valued at £1,057,550, and increased to 45 million in 1950-51. Output in the first 7 months of 1951-52 totalled 26.85 million. Actual production and production capacity (estimated) during 1949-50 by States were as follows—

Actual production (millions)—						
N.S.W.	VIC.	Q'LD.	S.A.	W.A.	TAS.	AUST.
21.5	11.5	2.5	(a)	(a)	(a)	(b) 43.5
Production capacity, estimated (millions)—						
N.S.W.	VIC.	Q'LD.	S.A.	W.A.	TAS.	AUST.
40	20	5	(a)	(a)	(a)	(b) 76

(a) Not available for publication.

(b) Includes particulars of States marked (a).

Because of reduced building activity recently, the supply of clay roofing tiles is, overall, adequate to demand. Cement tiles are meeting a considerable part of the demand for roofing tiles.

REFRACTORIES, CLAY AND OTHER

The production of refractories is a well-established activity, operating in every State, with emphasis on production in those areas of suitable raw materials that are in turn in reasonable proximity to their consumer industries. Hence New South Wales, the predominant steel-producing State, is also the largest producer of refractories.

In 1949-50 the value of refractories produced was £1,215,150. Imports and exports were small.

Sufficient capacity, coupled with necessary technique, is available to meet most requirements, though specialty lines, for example,

zirconite bricks, are imported. Shortage of coal is the limiting factor on present output which is well behind on delivery. A comprehensive range of BRICKS, CEMENTS and LININGS is produced, including fireclay, silica, alumina, magnesite, chromite magnesite, chromite, sillimanite, kyanite and silicon carbide; also diatomite thermal insulating bricks. Most raw materials, for example, fireclay, silica, magnesite, dolomite and some chromite, are of Australian origin and sufficient for requirements. Imported materials include some kyanite and synthetic grain such as silicon carbide.

EARTHENWARE, TABLEWARE, PORCELAIN, TERRA-COTTA

FINE TABLEWARE, decorated or undecorated, with earthenware body, is made in Australia in small quantities only. Ornaments of bone china have been produced in

small quantity recently, but dinner sets and other tableware, plaques, etc., of bone china are not made in Australia. It is not unlikely that there are suitable grades of clay available

for the production of fine crockery. In 1948-49 imports of ball clay were 176 tons, valued at £1,199, china clay 829 tons (£8,279) and other clays, 1,476 tons (£76,970).

The value of 1949-50 imports of all types and grades of crockery householdware, other than sanitary ware, was £3,116,752. The amount represented by fine crockery is not known, but is probably substantial. The wide choice of styles and grades to which the Australian user has been accustomed by importers of fine crockery is likely to be a significant factor in any appraisal of the market.

EARTHENWARE CROCKERY of utility type is in steady demand, but is made in Australia only in small quantities. A company with substantial capital backing (also established in ceramic wall-tiles manufacture and dominant in the glass industry) has announced plans for the quantity production of "utility type" crockery, but as yet (March, 1952) has not established a pottery for that purpose. Heavy grades of crockery are made by several companies in limited range; requirements are mainly met from importations. Pre-war one of the leading potteries (still in operation) made a full range of semi-vitrified hotelware.

ART POTTERY WARE is made in a wide range, mainly by small operators in this field. Details of imports are not available, but quantities imported are believed to be substantial.

The demand for **WALL and FLOOR TILES** (glazed and unglazed) is largely met from importations. In 1949-50 output was 169,029 square yards of glazed tiles and 106,884 square yards of unglazed tiles, valued at £300,054. Imports for the same period of glazed or enamelled flooring and wall tiles were valued at £426,600. One manufacturer with substantial capital backing has announced plans for erection of a second factory for the production of glazed wall tiles.

CHEMICAL STONEWARE, DRAIN PIPES, SEWER PIPES, DOMESTIC POTTERY WARE, etc., are produced in substantial quantities, but shortage of coal is affecting output. During 1949-50, the value of output of major items was as follows—

PRODUCTION:	1949-50
Stoneware pipes and fittings	£1,306,546
Terra-cotta ware for building purposes . .	105,256
Terra-cotta ware otherwise	49,418
Pottery (not including china tableware)	357,833
Tableware	(a)
Domestic earthenware and stoneware . .	172,587
Other earthenware, stoneware and enamelled fireclay ware	86,167

(a) Details not available for publication.

The demand for some items, particularly drain and sewer pipes, sometimes exceeds the supply.

The manufacture of **SANITARY EARTHENWARE** and **ENAMELLED FIRECLAYWARE** for building purposes, including **SANITARY WALL FITTINGS**, is well established. Output in 1949-50 was valued at £472,841, and imports were £279,140. These products are now freely available, and it is understood that some manufacturers are not operating at full capacity.

In 1949-50 the output of **PORCELAIN INSULATORS** and **ELECTRICAL FITTINGS** was valued at £523,002 and imports at £297,492. The industry has a large production capacity, but output, particularly of insulators for power distribution and communication purposes, is not sufficient to meet all of Australia's requirements. Fittings such as radiator cores, tubes, rods, coil forms, fuses, etc., are, in general, in adequate supply from manufacturers in Australia. The value of output of other types of porcelain ware in 1949-50 was £67,695.

GLASS AND GLASS PRODUCTS

The post-war demand for glass and glass products has expanded with the increase in population and improved economic conditions. Shortages of materials, labour and fuel have kept production slightly below established capacity. However, capacity is being extended to bring production closer to demand which at present exceeds supply. There is an extensive import trade not only of products also made in Australia, but in products not yet made here. Production of the following is undertaken—

SHEET GLASS: Plain, "Coldlite" (anti actinic), figured rolled (full range, including wire reinforced), heavy-drawn fire-polished plate, bent glass.

BUILDING BRICKS AND BLOCKS.

GLASS WARE: Domestic, dressed glassware generally, lighting ware, heat-resistant domestic and industrial, cut lead-crystal, neutral scientific, flint-blown scientific and industrial, medical including ampoules and neutral glass containers.

LAMPS: Bulbs and glass components for electric lamps, lamp chimneys.

RADIO VALVES: All glass components.

CONTAINERS: A full range of bottles, jars, phials and tubes, including opalescent pots and food tumblers.

TUBING: Pyrex, soda lime, lead, etc., scientific and fluorescent.

MARBLES.

TELEPHONE INSULATORS.

The glass industry consumed, in 1948-49, 96,000 tons of sand (102,074 tons in 1949-50), 33,000 tons of soda ash (32,395 tons in 1949-50), 30,000 tons of lime fluxes, 7,000 tons of felspar, 2,000 tons of dolomite, 350 tons of fluorspar, and quantities of by-product salt-cake of Australian origin. Borax, saltpetre, and most of the small amounts of colouring oxides, selenium, etc., were imported.

Details of output of glass and glass products in Australia are not published other than the value of containers produced. The value of output for 1948-49 of the whole of the glass-products industry, including fabricating and glazing, was £9.95 million, of which £3.7 million was for containers.

The value of all glass products (excluding optical and ophthalmic lenses) imported during 1948-49 was £2.69 million and in 1949-50, £2.95 million. All imports are now subject to licence—see Appendix II.

The demand for **SHEET GLASS** is well above current Australian production, and continuing substantial importing is necessary. The quantity produced in Australia is not published. Imports of sheet glass are substantial, and for 1948-49 and 1949-50 were as follows—

IMPORTS:

	1948-49		1949-50	
	sq. ft.	£	sq. ft.	£
Plain, clear	11,879,506	345,184	11,916,087	329,919
Figured rolled, cathedral, milled rolled, rough cast and wired cast	6,476,248	247,325	2,909,234	122,480
Opal	8,100	1,034	5,316	986
Opaque	38,995	5,671	37,799	4,828
Other	273,040	20,479	380,602	17,142
Totals	18,675,889	619,711	15,249,038	475,355

The principal source of imported plain clear sheet is Belgium, with the United Kingdom of next importance (a trade agreement, including window glass, is in operation between Belgium and Australia). The United Kingdom is the principal supplier of other types of sheet glass, with Belgium the second-largest supplier. Opal and opaque sheet glass are not made in Australia, and the demand would not appear to be sufficient to justify the establishment of such manufacturing capacity.

Practically all of Australia's requirements of PLATE GLASS are imported, although fire-polished plate is made here. Average imports for the five years before 1940 were 3.8 million sq. ft. a year, compared with 5.4 million sq. ft., valued at £743,544, in 1948-49, and 6.4 million sq. ft., valued at £910,737, in 1949-50. Most of these imports came from the United Kingdom and Belgium. Although the market appears to be large enough to justify Australian production, there are no known plans for entry into this field.

The supply of GLASS CONTAINERS in the post-war period has been short of demand to an extent seriously disturbing, at times, to big users of bottles; had it not been for shortages of some of the commodities required for beverage processing (white sugar particularly) the demand would have been even further ahead of supply. Some users imported bottles to supplement their Australian supply. The value of glass bottles and jars made in Australia in 1947-48 and 1948-49 was £2.95 million and £3.68 million respectively. Extensions to capacity for manufacture of glass containers resulted in substantial improvement in supply by the beginning of 1951, and recent extension appears likely to further reduce shortages. However, it is unlikely for some years that big users will have the opportunity to build up normal stocks from Australian production. Bottlenecking is in constant difficulty in maintaining their operating staffs at numbers necessary for full use of capacity, while soda-ash, cobalt, arsenic and borax are in short supply.

Although the value of glass containers imported is substantial, in fact, imports are less than 10 per cent. of Australian production. In 1948-49 and 1949-50 the value of these imports was—

IMPORTS:	1948-49	1949-50
	£	£
Bottles, flasks, jars, vials and tubes, of glass (except cut glass), earthenware or china (a)—		
Empty	191,504	137,014
Containing goods	68,244	119,143
Bottles, decanters, flasks and jars of cut glass, empty	390	4,833

(a) This item cannot be dissected to show glass only, but glass containers would constitute the major part.

The United Kingdom was the principal supplier of these imports.

Production of GLASS TUBING is now at a level close to demand, which is mainly for manufacture of neon-signs and cold-cathode

lighting fixtures. The quantity produced, and quantity imported, are not separately recorded in official statistics.

GLASSWARE, particularly flint-blown and heat-resistant varieties, has not been freely available from manufacturers in Australia in the post-war period, but capacity is being extended. Australian Consolidated Industries Ltd. is about to begin production (at March, 1952) at a glass-products factory being constructed at Brisbane, and plans to erect a new plant, near Newcastle, New South Wales, for heat-resistant oven ware and similar products, and is contemplating adding later a glass-container section at the new plant. Imports of heat-resisting glassware for cooking purposes are small; in 1948-49 such imports were valued at £5,624 and in 1949-50 at £6,222, mostly from the United Kingdom.

The greater part of FINE GLASSWARE is imported from the well-established, traditional sources in Europe. The value of these imports of miscellaneous glassware is substantial, and in 1948-49 and 1949-50 amounted to—

IMPORTS:	1948-49	1949-50
	£	£
Miscellaneous glassware (not cut glass), viz.:		
Dishes, tumblers, salads, bowls (other than lighting-ware), nappies, jugs, candlesticks, butters, battery jars or cells, vases, trays, comforts, flowerblocks, mugs, sundaes, goblets, measures including medicine measures	191,356	228,189
Glassware (not cut glass), n.e.i. . .	198,267	248,526
Articles of cut glass, n.e.i.	399,200	565,389

The United Kingdom and Czechoslovakia were by far Australia's largest suppliers of these items.

GLASS FIBRE is not made, nor is it spun or woven, in Australia. Imports are of United Kingdom origin, and are not separately recorded in official statistics.

GLASS POWDER is made in Australia, mainly by the principal user (a manufacturer of glasspaper abrasives), a company which also supplies other users. Medium grades (about 60-mesh) and some special grades are usually imported; in 1948-49 imports were valued at £1,693; in 1949-50, £91.

Standard SPECTACLE CROWN GLASS is not made, nor is there any moulding of blanks, in Australia. Imports of moulded blanks—single vision and multifocal—originate mainly from the United Kingdom. It is estimated that current annual requirements are over 1 million pairs of lenses, 10 per cent. of which are for tinted ophthalmic glass; the remainder in white glass. Single-vision lenses account for about three-quarters of total requirements.

As a wartime measure, and using local materials, OPTICAL INSTRUMENT GLASS of the highest quality (including dense barium crown) in a wide range of grades was made in Australia in adequate quantities. However, peacetime production was considered to be uneconomic and optical instrument glass is at present not made here.

Imports of optical glass and moulded ophthalmic blanks in 1948-49 and 1949-50 were as follows, the principal sources of these imports

being the United Kingdom, United States of America and Canada—

IMPORTS:	1948-49		1949-50	
	£		£	
Optical glass—				
In rough lump or block form, including roughly polished for examination purposes	—	4,545	—	7,892
Sheet, coloured	sq. ins. 116,503	275	sq. ins. 57,543	331
Sheet, not coloured	42,344	1,192	216	3
	no. 59,458	5,131	no. 295,799	8,420
Moulded optical glass blanks, lens and prism, coloured				
Moulded optical glass blanks, lens and prism, not coloured	287,723	11,632	1,499,823	39,396

VACUUM-FLASK BULBS were made as a wartime measure to meet defence requirements, but production was not continued in the post-war period. Australian production of bulbs for domestic flasks has been considered by one company which at present uses imported bulbs as a component in its production of two sizes of complete flasks. Imports of complete vacuum flasks, jugs, cans and similar vacuum containers and of parts are substantial; in 1948-49 imports were valued at £106,801 and in 1949-50 at £155,520. The principal suppliers were the United Kingdom and Hong Kong.

Because demand is considered to be insufficient to justify commercial production, SYPHON-BOTTLES and PROCESS-ENGRAVERS' SCREENS are not manufactured in Australia. The value of imports of these items in 1948-49 and 1949-50 was: Seltzogenes and accessories and syphon bottles, 1948-49 £31,336 and 1949-50 £18,515 (practically all from the United Kingdom); and process-engravers' screens £7,096 in 1948-49 and £6,886 in 1949-50 (mainly from Germany and the United States of America).

The GLASS FABRICATING and PROCESSING industry, including such activities as glazing, bevelling, mirror making, lead light-

ing, sand-blasting, laminating, toughening ("Armourplate"), etc., is generally well established, and is meeting a large part of the Australian demand. Imports of such processed glass were valued at £14,118 in 1948-49 (mainly from the United Kingdom); and at £44,504 in 1949-50 (from the United Kingdom and U.S.A.).

Australia's imports of LAMPS and LAMPWARE of glass in 1948-49 and 1949-50 were as follows—

IMPORTS:	1948-49		1949-50	
	£		£	
Lamps and lampware of cut glass	151		690	
Bowls and shades for lighting purposes, of glass other than cut glass	4,535		4,070	
Reflectors and refractors for lighting purposes, of glass other than cut glass	19,552		26,526	
Glass lamp chimneys	5,502 (a)		22,815 (b)	
Lamps, n.e.i., glass parts of lamps, n.e.i., glass bulbs and rods for use in manufacture of electric incandescent lamps . .	4,874		3,839	

(a) 5,565 dozen.

(b) 23,476 dozen.

The major part of these imports came from the United Kingdom.

CEMENT PRODUCTS (other than Asbestos-cement Products)

CONCRETE BUILDING BRICKS and BLOCKS, CEMENT ROOFING TILES and CEMENT WALL and FLOOR TILES are made by a large number of manufacturers. In the post-war period demand for these products has increased greatly owing to the shortage of clay bricks and tiles. Output was hindered by cement shortages rather than by lack of capacity, which is adequate. During 1948-49 output of concrete blocks and bricks (utilising about 50,000 tons cement) was about 120 million (expressed in standard brick equivalents) and cement roofing tiles about 39 million. Output of tiles was 48.2 million in 1950-51, and, in the first 7 months of 1951-52, 36.4 million.

Annual productive capacity for CONCRETE PIPES is about 30 million lineal feet. The

value of production in 1949-50 was £1,549,756, when plant was being worked at much below capacity because of shortages of cement, reinforcing rod and labour. Plant is now being worked at almost full capacity, and production is nearly adequate to demand.

During 1949-50, 296,361 cubic yards of READY-MIXED CONCRETE were produced, but this output was considerably below productive capacity, mainly owing to the shortage of cement.

A full range of BUILDERS' CONCRETE PRODUCTS, including washtubs, cisterns, basins, grease traps, etc., are made in Australia. In 1949-50 the value of output was £930,819.

ASBESTOS-CEMENT PRODUCTS

Output of principal ASBESTOS-CEMENT products in 1949-50 was 15.21 million square yards of flat building sheets (£1,807,999) and 3.14 million square yards of corrugated sheet (at finished size) (£572,217). Pipes to the value of £295,750 were produced in 1948-49 (production value for 1949-50 is not available.) Materials used were 17,305 tons of asbestos (£1,127,586) and 116,207 tons of cement (£581,612). Total output in 1950-51 was 21.5 million sq.

yds., and in the first 7 months of 1951-52, 12.85 million sq. yds. Production capacity for sheeting is about 36 million square yards.

Until recently shortages of materials, particularly asbestos, and the shortage of labour restricted the use of capacity. These shortages have been overcome and production is now adequate to demand, which has been reduced by the decline in building activity.

PLASTER PRODUCTS

By far the greater part of the output of plaster products is that of FIBROUS-PLASTER SHEETS and MOULDINGS. (Fibrous plaster is plaster of Paris set into various forms—mainly sheeting, cornice mouldings, cover strips—and reinforced with fibre, usually sisal. Thin wooden laths are also used as reinforcement for some products. The sheets and mouldings are used for interior lining of buildings, offices, public buildings, etc.) Production of sheeting in 1949-50 was 13.3 million square yards, valued at £2.5 million. In 1950-51 output was 12.9 million sq. yds., and in the first 7 months of 1951-52, about 8 million sq. yds. Value of output in 1949-50 of other plaster products, including fibrous-plaster mouldings and gypsum wallboard, was £635,559. Materials used for sheeting, mouldings, and other plaster products in 1949-50, were 114,495 tons of plaster of Paris, 3,461 tons of sisal

hemp, 2,222 tons of substitutes for sisal hemp (quantity of other materials, such as paper-board for gypsum wallboard, is not recorded).

Until recently, shortages of plaster of Paris caused production of fibrous-plaster products to be considerably below capacity. However, supplies are now adequate and fibrous-plaster products are meeting a reduced demand.

Production of GYPSUM WALLBOARD until recently was below demand, mainly because of the shortages of plaster of Paris. Gypsum wallboard is a comparatively recent innovation in Australia, and although improving in acceptance is not as widely used as fibrous-plaster sheeting (which is made in small-sized to medium-sized factories dispersed throughout Australia). The quantity and value of gypsum-wallboard production, including lath board, is not published as a specific item.

ABRASIVE PRODUCTS

The quantity and value of abrasive products produced in Australia is not published either in total or for one or several items. Manufacture of BONDED ABRASIVE PRODUCTS of wide variety is well established, but surface coating of abrasives is limited to GLASSPAPER and small quantities of EMERYPAPER. The coating of abrasive cloths and papers is planned by one company, which at present engages in cutting imported rolls of surface-coated abrasives into strips, squares, tapes, belts, special shapes, etc., to meet industry's requirements, of which it is the principal supplier.

Imports of bonded abrasives in 1949-50 were 29,735 lbs. (£2,472) of segments and similar components; 38,173 lbs. (£8,527) of silicon-carbide wheels; 48,839 lbs. (£9,292) of aluminous-oxide wheels; and 52,006 lbs. (£14,030) of wheels of other materials. Portion of the imports would be small-demand lines not usually made in Australia.

Imports of surface-coated abrasives in 1948-49 were valued at £351,800. Quantity is not published, nor is there a separation into broad types.

Many types of grinding and polishing compounds are produced by establishments, the combined activities of which are, or can be easily made, adequate to the demand. Imports in 1949-50 were 497,474 lbs. (£16,115), mainly a range of materials in small quantities.

Solid and liquid resins, silica (diatomite), clays, felspar, quartz, zircon, broken glass, paper backing, diamond powder (including very fine mesh), are reasonably available in Australia, but glue, and steel shot and grit, normally freely available, have been short, and remain so. Installed capacity for manufacture of steel shot and grit is stated to be adequate, but cannot be used to the full because of shortage of suitable material. Australian calcined dolomite has not yet proven adaptable. Shellac, fondu, twill and calico backing cloths, emery grain and synthetic grain are all imported and all in short supply. Imports of grain in 1949-50 were 704,520 lbs. (£31,400) of silicon carbide, 706,900 lbs. (£31,270) of aluminous oxide, and 913,354 lbs. (£40,575) of abrasive grains of other types.

ASBESTOS PRODUCTS

A wide range of asbestos products, including MATTRESSES, FILTER PADS, PACKINGS, LAGGINGS, CORDS, GASKETS, and some types of GARMENTS, is made up in Australia by a few specialist fabricators (mainly two companies), and BRAKE and CLUTCH LININGS, SHAPED BLOCKS and an 85% MAGNESIA LAGGING are made by a company principally concerned with manufacture of asbestos-cement products.

Asbestos yarn, fabric, boards and paper are not made in Australia. Imports in 1949-50 of these basic materials and some fabricated asbestos products were as follows—

IMPORTS:	1949-50
Asbestos yarn	£9,228
Asbestos cloth (unproofed)	85,412
Asbestos cloth (proofed with rubber)	1,927
Asbestos cord	10,896
Asbestos mattresses for boilers and pipe and boiler covering	8,221
Asbestos millboards	23,065
Other asbestos packing materials	106,490
Asbestos metallic gaskets	19,723

It is estimated that 3 to 10 per cent. of the total asbestos fibre consumed in Australia (16,300 tons in 1948-49) is used in the manufacture of products other than asbestos-cement products.

GRAPHITE PRODUCTS

There are no published statistics of production of graphite products in Australia, and only limited overseas-trade statistics are available.

Adequate capacity exists for graphite milling and treatment, including production of FOUNDRY FACINGS and LUBRICANT

GRAPHITE, the latter from imported colloidal graphite. The range of CRUCIBLES and FOUNDRY ACCESSORIES made in Australia is wide and as far as is known those products are in reasonably good supply from the two manufacturers. All hard grades of CARBON BLOCK are imported, and some soft

grades are made in Australia; imports of carbon manufactures, including carbon block and brushes, in 1949-50 were valued at £248,709.

Consumption of graphite in 1949 has been estimated at 1,000 tons (210 tons of which was

flake). The estimated uses were 590 tons for foundry facings, crucibles, accessories; 300 tons for dry-cell batteries; and 110 tons for polishes, lubricants, pencils, packings, paints, electrical equipment, etc.

MICA PRODUCTS

There are no published statistics of production of mica products in Australia. A few specialists, well established, make condenser plates, built-up mica products, precision mica products for radio, telephone and radar equipment, tubes, washers, micanite sheet, and so on.

The splittings required (about 120 tons a year at present) for micanite sheets are not produced in Australia; for economic reasons

it is preferred to import splittings, mainly from India.

Fabricating technique in Australia is well advanced, enabling satisfaction of most of Australia's requirements in variety and quantity of products and permitting exports, which in 1949-50 were valued at £40,714, practically all Australian produce. Imports of mica manufactures in 1949-50 were valued at £15,570, of which £5,070 came from India and £10,216 from the United Kingdom.

MINERAL-EARTHS PROCESSING

The activity is well established in all States, its location being influenced by proximity to considerably varied consumers rather than to raw materials, owing to the multiplicity of products processed. In some cases, however, the companies concerned have located sections of their business adjacent to certain raw material sites, whilst concentrating their main activities in the capital cities. There are no published statistics of production by trade mineral-earths processors in Australia, but as far as is known the industry meets the demands placed on it provided material and labour are available.

Activities in addition to quarrying, beneficiation and transportation include such processing as breaking, grinding, sizing, calcining and drying, and also selecting and grading according to chemical or physical specification, and formulae mixing to clients' order. The range of products in their various gradings is very considerable, and there are few industries that are completely independent of such products. Talc, kaolin, clays, silica, feldspar, fluorspar, limestones (marble milled as calcite flour), dolomite, magnesite, bentonite, fullers' earth, barite, bauxite, graphite, diatomite, ochres and mineral pigments, whiting (from Mt. Gambier limestone), asbestos, are among the products offered as standard grindings for the paint, ceramic, chemical, rubber, cosmetic, pot-

tery, metal polish, abrasive, iron founding and other industries. Although emphasis is on materials of Australian origin, imported materials are also processed. Waste materials from manufacturing industries are also processed, mainly by grinding.

The processing or refining of diatomite for production of "ACTIVATED" DIATOMACEOUS EARTH is carried out by two companies. One of the companies uses its production largely for its own use as a filter medium in gelatine manufacture, and sells excess production. The other company is a heavy-chemicals manufacturing company. Production in 1948-49 was estimated to be about 800 tons. Apart from the use stated above, the material is used as a filter medium (not a filter aid) in purification of water for potable use and for cleansing and reclamation of white spirit used in dry-cleaning of garments, etc. (Imports of material stated to be diatomite, from U.S.A., are not run-of-mine material, but are the "activated" diatomaceous earth.)

Production of ZEOLITE (glauconite-base exchange medium) is well established, by one company, operating at Middle Swan, W.A. Output in 1948-49 was about 260 tons, of which about one-quarter was consumed in Australia and the remainder exported to the United Kingdom. Zeolite is almost exclusively used for water softening.

MINERAL WOOL AND PRODUCTS

The actual quantity of mineral wool produced in Australia by the two companies engaged in its manufacture is not published, but is probably more than 10,000 tons a year. This would require considerable quantities of slag, siliceous limestone, hornfels, etc., as raw materials, and small quantities of dolomite

and magnesite. Output in Australia has increased over recent years, due to widened use, probably resulting from vigorous advertising by the manufacturers of the insulating qualities of mineral wool and the provision of installation services. Imports and exports are negligible.

MODELS AND COMMERCIAL SCULPTURING

There are several firms which carry out modelling in clay and plaster and similar

materials, mainly to order, and in general satisfy the demand.

Part Three: Basic Statistics

COMPARATIVE STATISTICS, 1938-39 1949-50

NUMBER OF ESTABLISHMENTS AT 1938-39 AND 1949-50

NUMBER OF EMPLOYEES AT 1938-39, 1949-50, JUNE 1950, SEPTEMBER 1951

Activity (Statistical Sub-classes used by Commonwealth Statistician, 1949-50)	E-establishments		Employees			
	1938-39	1949-50	1938-39	1949-50	June 1950 (a)	Sept. 1951 (a)
	no.	no.	no.	no.	no.	no.
Salt (b)	24	17	255	405	232	227
Marble, Slate, etc. (c)	141	169	1,684	1,669	1,517	1,509
Lime, Plaster of Paris, Asphalt (d)	(c)263	101	(c)3,418	1,212	(f) (g)	(f) (g)
Fibrous Plaster and Products		355		3,174		
Cement, Portland	(j)132	11	(j)3,932	2,152	(g)8,343	(g)8,614
Asbestos Cement Sheets and Mouldings		14		1,946		
Other Cement Goods (h)	(i)296	425	(i)7,719	3,935	8,458	8,955
Bricks and Tiles (k)		286		8,332		
Earthenware, Tableware, Porcelain and Terra-cotta (m)	(i)72	124	(i)2,761	3,332	3,276	3,259
Glass Bottles (n)	9	7	2,312	2,669	(g)7,621	(g)7,924
Glass (other than bottles) (o)	86	130	2,835	4,789		
Other, and Carbide (of Class I) (p)	17	42	286	853	515	517
Other (of Class II) (q)	8	14	78	119	101	126
Totals (r)	1,048	1,695	25,280	34,587	35,363	36,691

STATISTICAL SUMMARY, 1949-50

EMPLOYMENT, MALE AND FEMALE

SALARIES AND WAGES PAID, IN TOTAL AND PER PERSON ENGAGED

VALUE OF PRODUCTION

VALUE OF MATERIALS, POWER, FUEL, REPAIRS, etc.

VALUE OF OUTPUT

See Explanations,
Appendix IV

Activity (Statistical Sub-classes used by Commonwealth Statistician, 1949-50)	Employment			Salaries and Wages Paid		Value of Pro- duction	Value of Materials, Fuel, etc. Used	Value of Output
	Males	Females	Persons	Total	Per Person Engaged			
	no.	no.	no.	£'000	£	£'000	£'000	£'000
Salt (b)	388	17	405	169	417	278	317	595
Marble, Slate, etc. (c)	1,615	54	1,669	726	435	1,293	990	2,283
Lime, Plaster of Paris, Asphalt (d)	1,167	45	1,212	585	483	1,148	2,161	3,309
Fibrous Plaster and Products	3,064	110	3,174	1,225	386	1,959	1,881	3,840
Cement, Portland	2,094	58	2,152	1,048	487	2,150	3,272	5,422
Asbestos Cement Sheets and Mouldings	1,881	65	1,946	970	498	1,490	1,976	3,466
Other Cement Goods (h)	3,831	104	3,935	1,654	420	2,900	2,867	5,767
Bricks and Tiles (k)	8,184	148	8,332	3,923	471	5,257	2,685	7,942
Earthenware, Tableware, Porcelain and Terra-cotta (m)	2,779	553	3,332	1,470	441	2,099	811	2,910
Glass Bottles (n)	2,528	141	2,669	1,171	439	2,121	2,350	4,471
Glass (other than Bottles) (o)	4,222	567	4,789	1,929	403	3,347	3,829	7,176
Other, and Carbide (of Class I) (p)	735	118	853	395	463	833	895	1,728
Other (of Class II) (q)	100	19	119	47	395	80	32	112
Totals (r)	32,588	1,999	34,587	15,312	443	24,955	24,066	49,021

Explanatory Footnotes to Both Tables

- These employment figures are taken from monthly payroll-tax returns and differ slightly from the other employment figures, which are supplied on annual factory returns.
- Crushing, washing, grading, sterilising. Does not include harvesting.
- Also includes stone crushing (where separate from quarrying, or where associated quarrying is the minor activity); monumental masonry and stone dressing generally; mosaic products; terrazzo products. Does not include the laying of "on-site" mosaic and terrazzo.
- The "Asphalt" portion of the sub-class "Lime, Plaster of Paris, Asphalt" is not statistically separable. The "asphalt" activity is that of manufacture of bitumen emulsions and cutbacks and bituminising of various materials; the activity is dealt with in this study in Chapter 1, "Fuels, Lubricants, Light, Power"—see footnote (h), page 17.
- At 1938-39 the sub-class "Lime, Plaster of Paris, Asphalt" included the present sub-class of that title and also the present sub-class "Fibrous Plaster and Products".
- Also includes "Coke Works" (of the Commonwealth Statistician's Class I, "Treatment of Non-metal-liferous Mine and Quarry Products")—see page 17.
- Separate figures for each sub-class were not published.

- (h) Also includes ready-mixed wet concrete; ready-mixed dry concrete; concrete pipes, posts, etc.; concrete ("cement") building bricks, blocks, tiles, slates; prefabricated housing units of concrete; cinder-concrete building bricks and blocks; cement renderings; ready-mixed mortar.
- (j) At 1938-39 the present sub-classes "Cement, Portland", "Asbestos Cement Sheets and Mouldings" and "Other Cement Goods" made up one sub-class entitled "Cement and Other Goods".
- (k) Also includes clay refractories; and also non-clay refractories where made as a lesser activity in association with clay refractories (which is the usual circumstance in Australia).
- (l) Potteries in Tasmania were included in "Bricks and Tiles".
- (m) Also includes stoneware, bristolware, etc.
- (n) Also includes jars and other containers of glass.
- (o) Includes sheet glass; glass bricks and blocks; and glassware generally; also includes optical glass (but not lenses—optical, camera, instrument); technical, scientific and laboratory glassware; laminating of sheet glass, etc.; toughening of plate glass; leadlights; silvering and bevelling; sand blasting of glass; glass fabricating otherwise.
- (p) The sub-class "Other" is one of miscellaneous activities not elsewhere covered within the Commonwealth Statistician's Class I, "Treatment of Non-metalliferous Mine and Quarry Products". The sub-class includes coated and bonded abrasives; asbestos products; non-clay refractories (where the sole or major activity); graphite products (see also footnote (k) above for graphite refractories); gypsum wallboard and lath; mica products; mineral-earths processing; mineral-wool and made-up products; sand/lime building bricks and tiles. Added to the statistics of the sub-class in the above table are the statistics of another sub-class, that of "Carbide", of Class I—see footnote (e), page 123, this study (in Chapter 6, "Chemical and Associated Industries") for explanation; the activity of calcium-carbide manufacture (and the manufacture of acetylene black associated with it) is dealt with in that chapter.
- (q) The sub-class "Other" is one of miscellaneous activities within the Commonwealth Statistician's Class II, "Bricks, Pottery, Glass, etc.". The sub-class includes commercial sculpting of clay; models, etc. of plaster, clay, etc.
- (r) Consideration and comparison of totals must take into account the effects stated in footnotes explaining the composition of certain sub-classes and figure units.

Chapter 3:

TIMBER PREPARATION

PRODUCTS OF WOOD, CANE, BARK, CORK, STRAW

Part One: Structure of Established Manufacturing Activities

THE preparation of timber by hewing, splitting, billeting, sawing, immunising, seasoning, dressing, moulding, peeling, slicing or otherwise processing, the grinding of bark for tanning, the manufacture of intermediate and end products entirely or mainly of wood, and of products entirely or mainly of cork, cane and straw, are established in Australia as listed below, the extent of association of activities being shown by bracketing and annotation. The listing is intended to be reasonably indicative, but not necessarily fully inclusive.

TIMBER PREPARATION AND WOOD PRODUCTS

DIRECT CONVERSION OF TIMBER FOR USE IN ROUND, HEWN OR SPLIT FORM: Poles and piles are usually felled by individuals and, when necessary, desapped and shaped with hand tools at or near the source of supply. Posts, mine props, and slabs are sometimes split, sometimes trimmed in rounds, at or near the source of supply. Sleepers and beams are hewn in the forest. Billeting is undertaken sometimes for the preparation of material for slicing into fancy veneer or box shooks. Staves and palings are split from selected logs of suitable timbers—mostly in association with logging for other purposes. Pulpwood is felled, crosscut, split (if necessary) and barked; it is procured from regenerated forests, from plantations, from cut-over forests as salvage operations, and sometimes logged concurrently with saw-logs. Firewood timber is felled, crosscut and split for household and industrial fuel. (Direct conversion is classified statistically as a non-manufacturing activity, unless carried on in direct association with a sawmill—that is, a factory. Little statistical information is recorded of direct conversion as a separate activity.)

TIMBER—SAWN, SEASONED, DRESSED AND MOULDED: Sawmilling, including immunising and kiln drying, is widespread throughout forest (bush mills), country towns and metropolitan areas. During 1949-50 there were 2,711 mills. In 1948-49 there were 2,472 mills: of these, 688 each employed under 4 persons, 195 each employed 4 persons, 775 each between 5 to 10 persons, 514 each from 11 to 20, 226 each from 21 to 50, 51 each from 51 to 100 and 23 each employing 101 persons and upwards; of the total of 2,472 establishments, 88 per cent. were in the group employing up to 20 persons, and collectively employed 15,143 persons out of the industry total of 28,871 persons. (The average output per mill is less than 0.5 million superfeet each year. Few mills exceed 0.5 million superfeet a year.) The large mills have diverse production, comprising boards for seasoning or for manufacturing purposes, building scantlings, engineering constructional timber and small dimensional products such as shooks, palings, handle blanks and so on. Small mills tend to concentrate on scantlings, or sleepers, or boards, or case timber, but many produce several lines. The majority of mills produce more or less to order in sizes in which the timber is ultimately used. Australian hardwoods do not store well in bulky sections, and hence supply for resawing is restricted.

The trade does not hold a large stock of timbers between sawmillers and distributors, except for the technically necessary purpose of seasoning. Hardwoods predominate in the total Australian production. Legislation has been introduced in New South Wales and Queensland requiring the immunisation of timbers against attack by *Lyctus* borer. About 20 firms have installed immunising equipment, and associate its operation with sawmilling and seasoning activities. Seasoning is commonly undertaken at the mill site. Kilns are operated at many mills. A few establishments in large country towns, or in metropolitan areas, specialise in kiln drying, and these draw supplies from more than one sawmill. Many mills in well-populated areas are associated with drying, dressing, moulding and joinery activities, or with case manufacturing, sometimes to the extent that the end activity is a major part of the company's operations. Some make small products of wood by mass-production machinery (such as handles of various types) as a specialised sideline. Some large mills (mainly in Queensland) are linked with plywood manufacture. Three are linked with pulpwood production.

CASES AND BOXES: During 1949-50, there were 360 mills operating, employing 4,487 males and 174 females. Mills engaged wholly or mainly in case, crate and boxmaking from the log and/or flitch stage numbered 369 establishments in 1948-49, generally located in metropolitan areas. Of these, 246 each employed less than 10 persons, 61 each from 11 to 20 persons, and 62 each 21 and upwards, including 7 each employing more than 101 persons. The 21-50 employment-size group collectively employed 1,407 persons out of the industry total of 5,227 persons. Many of the mills also supply shooks to packers and warehouses which make their own boxes, cases and crates. Most of the larger case mills have board-printing equipment. Some mills also utilise second-hand cases and case timber.

VENEERS, PLYWOODS, COREBOARD. During 1949-50, 46 establishments employing 2,171 males and 259 females were operating. In 1948-49, 47 establishments were wholly or mainly engaged in manufacture of plywoods, etc. Of these, 11 each employed up to 10 persons, 6 each between 11 and 20, 21 each between 21 and 100, and 9 each had more than 100 employees; the 9 latter establishments collectively employed 1,189 persons out of the industry total of 2,306 persons.

Manufacture of veneers in association with the plywood industry.

Plywood making from peeling and/or slicing stage to finished sheets and panels.

Corestock.

Core-board—One manufacturer produces a veneered coreboard (core made of sawdust bonded with phenol formaldehyde resin under heat and pressure, sandwiched between veneers) for use in furniture manufacture, etc.

A small number of mills peel or slice veneers only, for distribution to manufacturers of plywood, panels, or furniture. Most producers of veneers, however, also manufacture plywood. Some of these also manufacture corestock, but the latter is sometimes conducted as a separate activity.

Apart from the above activities associated with the plywood industry, about seven firms are engaged in the production of veneers for the manufacture of matches, berry baskets, ice-cream spoons and sundry minor products. These products are dealt with under "Matches," and "Woodworking and Woodware Products", later this Part.

WALLBOARDS (OF FIBRE): In 1949-50 there were five establishments wholly or mainly engaged in the manufacture of wallboards from fibrous materials, and eight establishments engaged in processing hardboard by surface-coating. In 1948-49, six establishments each employed up to ten persons, 3 each employed from 11 to 20 persons, 2 each from 21 to 50 persons, and two each more than 100 persons; the latter two establishments together employed 641 persons out of the total of 761 persons for this group.

HARDBOARD: Three manufacturers. Colonial Sugar Refining Co. Ltd., Masonite Corporation Ltd., Paper Makers Pty. Ltd. C.S.R. Ltd. is the largest refiner of sugar in Australia, and is also engaged in gypsum and asbestos mining, manufacture of asbestos-cement sheets and mouldings, gypsum wallboard, fibrous-plaster sheets and mouldings, insulating board, asbestos-based floor-tiles, and other building materials, and in manufacture of chemicals. Masonite Corporation Ltd. is concerned only with hardboard manufacture, and is associated with a leading producer of similar wallboard in the U.S.A. Paper Makers Pty. Ltd., a wholly-owned subsidiary company of Associated Pulp & Paper Mills Ltd., is concerned with hardboard production (with sawmilling of building timbers to be added in 1952), carried on as an integrated part of the operation of forests primarily for pulpwood for paper manufacture by the parent company.

INSULATING BOARD: Colonial Sugar Refining Co. Ltd. is the only manufacturer, and uses bagasse (sugarcane waste); see previous activity.

WOODWOOL-CEMENT BOARD: One manufacturer, with a small establishment.

COMPRESSED-STRAW INSULATING BOARD: One manufacturer; see also Straw Products, later this Part.

COATING OF HARDBOARD: About eight processors, producing imitation tiling in flat and bends; one processor produces school blackboards.

JOINERY AND SIMILAR ACTIVITY: During 1949-50, there were 1,226 establishments operating employing 11,141 males and 383 females. In 1948-49 there were 1,102 establishments wholly or mainly engaged in manufacture of one or more of the categories listed below. Of these latter establishments, 848 each employed up to 10 persons, 133 each from 11 to 20 persons, 93 each from 21 to 50 persons, 24 each from 51 to 100 persons, and 4 each more than 100 persons. The 11-50 employment size group collectively employed 4,776 persons out of the industry total of 10,659 persons.

GENERAL JOINERY (for example, doors, window frames): Mainly carried out both as a separate activity, or in association with sawmilling, seasoning, etc.—either as an incidental or major activity. The mass production of joinery items in Australia is mainly carried out by several mills in the latter group.

COFFINS: Manufactured by small number of makers who supply the smaller, and some larger, undertakers. Some of the latter manufacture coffins for their own activities.

LADDERS: Made by several firms, at least two of which are medium- to large-sized organisations. Frequently associated with the production of stepladders, extension planks, and, sometimes, garden seats.

SHOW CASES, SHOP FITTINGS AND OFFICE FITTINGS: Made and fitted by numerous manufacturers, many of which are old established firms; some are large organisations. A few makers also produce general furniture items, and several operate as glaziers in association.

COOPERAGE: During 1949-50, 48 establishments employing 764 males and 10 females were operating. In 1948-49 barrels, casks, brewers woodware were produced by 49 establishments, wholly or mainly engaged in this work. Of these, 30 each employed up to 10 persons, 9 each from 11 to 20 persons, 7 each from 21 to 50 persons, 2 each from 51 to 100 persons, and 1 employed 139 persons; the industry total employment was 773 persons. Coopers are established in each metropolitan area, and occasionally in country districts. A number of breweries and wineries have coopers shops for the manufacture of part of their requirements and/or for repair work. (Woodpipe is made by one company only—see "Woodworking and Wood Products", later this Part.)

BROOMS AND BRUSHES: During 1949-50 103 establishments employing 1,444 males and 681 females were operating. In 1948-49, 100 establishments were wholly or mainly engaged in the manufacture of a wide variety of brooms, mops, dusters, brushes, and carpet sweepers. Of these establishments, 56 each employed up to 10 persons, 21 each from 11 to 20 persons, 13 each from 21 to 50 persons, 5 each from 51 to 100 persons, and 5 each more than 100 persons; the latter ten establishments collectively employed 1,121 persons out of the industry total of 2,116 persons. The larger firms make a wide range of products; smaller firms usually specialise in one or more groups, such as brooms, painters' brushware, or industrial brushware. There are two manufacturers of toothbrushes, one producing on behalf of the largest company making surgical dressings, bandages, waddings, etc., in Australia, the other a plastics-products manufacturing unit in a large associated group of manufacturers of electrical products, household equipment. Institutions for blind persons are an important section of the industry. The manufacture of carpet sweepers is carried on by a small number of firms, which are closely associated with the sheetmetal working industry. One manufacturer of carpet sweepers also makes ladders and similar equipment.

MATCHES (Wood Safety, Wax and Waterproof): There are five match factories in Australia, of which three are associated with an international match organisation. During 1949-50 the five factories employed 449 males and 575 females. In 1948-49, one establishment employed 37 persons, one 82 persons, and the other three establishments, each with more than 100 persons, collectively employed 916 persons; the industry's total employment was 1,035 persons.

WOODWORKING AND WOOD PRODUCTS: During 1949-50, 338 establishments were operating, employing 2,519 males and 350 females. In 1948-49, 331 establishments were wholly or mainly engaged in one or more of the categories listed below. Of these establishments, 163 each employed up to 4 persons, 89 each from 5 to 10 persons, 48 each from 11 to 20 persons, 25 each from 21 to 50 persons, and 6 each from 51 to 100 persons. The 300 establishments of the group employing 20 persons or less, collectively employed 1,696 persons out of the industry total of 2,903 persons. Most of the manufacturers engaged in the woodworking activities listed below are specialists within one or a few categories.

WOOD MACHINING (turning, carving): Carried on by numerous small-sized to medium-sized firms, mostly in the metropolitan areas. Some specialise in the production of turned components for the furniture trade. Small jobbers complete some items for sale. Timber merchants and specialty workers undertake manufacture to order. Material may be dressed or run to detail. Cabinet makers and venetian-blind manufacturers use such services. A variety of manufacturers produce kitchenware, bowls, switch blocks, bakers' requisites, and so on.

CLOTHES PEGS: Made by several manufacturers, at least two being specialists.

DOWELLING: Made by some specialists, but also associated with production of mouldings and/or handles.

PUNNETS AND FRUIT BASKETS: Made by one specialist, also producing sundry minor articles of wood.

SPOONS AND STICKS: Only two known manufacturers, also producing minor wood articles.

HANDLES: Made by several manufacturers, some being specialists. Production is sometimes carried on in association with general woodturning, with brush or tool production, and with sawmilling.

SMOKING PIPES: Made by a small number of specialists.

MULGAWOOD NOVELTIES: Made by several small manufacturers, most being specialists.

DENSIFIED WOOD PRODUCTS: One manufacturer only, producing compressed impregnated veneer laminate for high-tension electrical insulation, textile woodware, tool handles, skis, and so on.

TEXTILE WOODWARE: Bobbins, reels, pirns, etc., are manufactured by a few specialists.

MODELS OF WOOD: Made by a few specialists.

INCUBATORS AND BROODERS (mainly of wood): Made by several firms in metropolitan areas.

WOOD BENDING: Carried on by a small number of specialists and, in at least one case, is associated with sawmilling.

MARQUETRY AND INLAY: Little activity; some producers of veneered panels engage a craftsman to produce sidelines.

PARQUETRY: Parquetry flooring is produced by a small number of metropolitan firms, mostly in association with general floor surfacing activities, although a few are specialists.

PAVING BLOCKS: Little activity—orders confined to minor quantities for maintenance of existing pavements.

WOOD PIPE: One firm, which also manufactures vats.

WOOD PATTERNS, including engineering (includes associated making of metal patterns where the lesser activity) and such patterns as hat blocks: Carried on by a substantial number of firms, nearly all specialists.

WOODEN SLATS FOR BLINDS: Produced by a small number of firms, some of which also manufacture metal blinds.

(The manufacture of wood heels, lasts, etc., for the footwear industry, is covered in this study in Chapter 16, "Clothing, Manchester, Napery, Footwear". The manufacture and/or assembly of venetian blinds, slat blinds, etc., is covered in the section on interior blinds, Chapter 17, "Products of Textiles and/or Wastes, Cordage, Hair, Not Elsewhere Included".)

TAN-BARK GRINDING

During 1949-50 there were 23 bark mills operating, employing 55 males. In 1948-49 there were 22 bark mills, employing 83 persons; none of the mills employed more than 20 persons. The bark is stripped from the trees by individual forest workers, who work under contract with agents for the larger tanners and some merchant firms who operate bark mills. The latter firms supply the smaller tanners with their bark requirements. (Manufacture of tanning extract is dealt with in Chapter 6, "Chemical and Associated Industries".)

WOOD-WOOL, WOOD-FLOUR, AND PRODUCTS OF CORK AND STRAW

Activities concerned with the manufacture of other products of wood not previously covered in this Part (not being furniture, etc.), and of products of cork and straw, are listed below, with, where known, the number or an approximate number of manufacturers so engaged. (The activities listed below, where carried on as the sole or major activity, are for official statistical purposes grouped into a sub-class of miscellaneous activities.)

WOOD-WOOL: Produced by a small number of manufacturers; at least one, the largest, is a specialist.

WOOD-FLOUR: Two processors, including the only manufacturer of linoleum in Australia, produce wood-flour from sawdust.

CORK: Processing of cork in Australia (dependent upon the importation of scrap cork, etc.) includes milling, pressing, and baking, slitting, cutting, punching and stamping. The industry is integrated vertically insofar as most of the processors import cork bark and/or scrap, mill, press, bake and slit, or punch and trim in their individual factories, and some follow through to other end products by cutting, stamping, etc. Five firms process selected better-quality natural bark, one agglomerating into moulded rod, and one into compressed sheet. Four firms, including one in the former group, process lower-grade cork scrap. Additionally, many firms process cork complementarily to other activities.

STRAW: Straw envelopes for packing of bottled wine and spirit are made by a few specialist firms. (There is also one manufacturer of an insulating board made from compressed wheaten straw—see Wallboards, earlier this Part.)

FURNITURE, BABY CARRIAGES, WICKER AND BASKETWARE, PICTURE FRAMING

FURNITURE MAINLY OF WOOD OR WITH WOOD FRAME: During 1949-50, 1,379 establishments employing 14,857 males and 918 females were operating. In 1948-49 there were 1,320 establishments wholly or mainly engaged in manufacture of one or more of the categories of general household furniture (including upholstering, hair processing and curling), ice chests, radio and radiogram cabinets, nursery and kindergarten furniture, billiards tables and equipment. Of those establishments, 619 each employed up to 4 persons, 342 each from 5 to 10 persons, 155 each from 11 to 20 persons, 150 each from 21 to 50 persons, 42 each from 51 to 100 persons, and 12 each more than 100 persons, and collectively 1,841 persons out of an industry total of 15,404. Nearly three-quarters of the number of establishments employed 10 persons or less.

FURNITURE MAKING, including household, cabinet furniture and frames for upholstered furniture, office, school, church, factory and shop furniture: There is little overlapping between the different types of production of furniture. The industry is specialised to a fairly high degree, many manufacturers confining their activities to a few types of products, and sometimes to a restricted quality range within a particular type. The association of manufacture with distribution varies according to trade practice within the States. In Victoria, New South Wales, South Australia and Tasmania, about 75 per cent. of furniture produced is made by wholesale manufacturers for distribution through separate channels, the balance coming from a few large makers who retail through their own specialist shops or emporium departments, and a number of small craftsmen doing high-class work to customers' orders. In Queensland and Western Australia, trade practice inclines to production by manufacturers, who sell direct to the public through their own retail organisations. There are several manufacturers of tubular and other steel furniture for household, office and factory use. (Metal-furniture manufacture is covered in Chapter 12, "Machinery, Plant, Equipment, Apparatus, Not Elsewhere Included".)

HAIR PROCESSING FOR UPHOLSTERY AND BRUSHMAKING (drawing, drafting, curling, dry teasing, carding, spinning into rope, and reteasing, of animal hair, mainly horse, cattle and hog): One company controls three factories (two in Victoria and one in New South Wales), which process hair for the brushmaking and upholstery trades. Four other New South Wales companies are mainly engaged in drafting hair. All hair used is produced in Australia. (One company with two factories (one in Victoria, one in New South Wales) concerns itself only with cleaning and drying of bovine body hair for supply to the company of which it is a subsidiary and associated subsidiary companies for manufacture of hard hair felt and needled jute/hair felt. See Chapter 15, "Textiles, Felting, Cordage".)

ICE CHESTS: Made by several firms, including at least two large specialist manufacturers making wood-sheeted chests, and steel-sheeted chests with wood frames. (One of the latter organisations is a large manufacturer of ice.) A number of the smaller manufacturers make articles of kitchen furniture in association with ice chests. Some also make general furniture.

RADIO AND RADIOGRAM CABINETS: Made by a small number of firms, most of whom are specialists. A few of the larger radio manufacturers have their own cabinet-making shops.

NURSERY AND KINDERGARTEN FURNITURE: There are several manufacturers, sometimes in association with the production of baby carriages, but often made by manufacturers of general and/or kitchen furniture, as a means of using short lengths and offcuts to profitable advantage.

BILLIARDS TABLES AND EQUIPMENT: Made by a few specialist manufacturers.

PERAMBULATORS, PUSHERS, STROLLERS: During 1949-50, 44 establishments employing 373 males and 70 females were operating. In 1948-49, 46 establishments were wholly or mainly engaged in this industry. Of these, 35 each employed less than 11 persons, while, of the remainder, 10 each employed between 11 and 50 and one between 51 and 100 persons out of an industry total of 427. The manufacture of perambulators and other baby carriages is sometimes associated with the production of nursery and kindergarten furniture. Two of the leading manufacturers of baby carriages make imitation wickerware ("Reedtex"), using spun paper, and also make piping cords and similar products of spun paper (see Chapter 5, "Paper Products, Printing, Signwriting, Photographic Materials").

WICKER FURNITURE AND WICKERWARE: During 1949-50, 63 establishments employing 405 males and 23 females were operating. In 1948-49 there were 57 establishments wholly or mainly engaged in the production of wicker furniture (including seagrass and bamboo furniture) or of basketware, usually in one group or the other. Of these 57 establishments, 26 each employed up to 4 persons, 24 each from 5 to 10 persons, 6 each from 11 to 50 persons, and one employed 67 persons. Establishments employing 10 persons or less employed collectively 232 persons out of the industry total of 419 persons.

WICKER FURNITURE: Made by a small number of specialist firms, which in some instances also produce limited quantities of seagrass furniture.

BASKETWARE: Manufacturers within this activity usually specialise in either the large or the small basketware products—those making industrial basketware such as laundry and wool baskets, textile skips, and so on, usually do not make shopping and other small baskets. Institutions for blind persons are also usually manufacturers of basketware.

PICTURE AND MIRROR FRAMES AND FRAMING: During 1949-50, 39 establishments employing 224 males and 95 females were operating. Most of these establishments (31 of the 39) were small organisations each employing less than 11 persons. The remaining 8 each had between 11 and 50 employees. This is largely a specialist activity, undertaken principally in metropolitan areas.

Part Two : Outline of Capacity of Manufacturing Activities

MANUFACTURING industries based on timber and dealt with in this part include sawmilling, bark stripping, the manufacture of wood products from sawn timber, veneering and the manufacture of veneered products (plywood, matches, etc.), hard-board manufacture, and complementary minor activities (for example, wood-flour and wood-wool). The manufacture of products from cork, cane and straw is also reviewed. Firewood, roundwood (poles, piles, etc.), hewn timber (sleepers, palings, etc.), and mining timbers and charcoal burning, are regarded as being end uses, and are not given detailed treatment. Of the other industries, similarly dependent upon forest resources, paper and allied products are dealt with in Chapter 4, "Pulp, Paper, Paperboard", and wood-destructive distillations in Chapter 6, "Chemical and Associated Industries".

SAWMILLING AND ASSOCIATED ACTIVITIES

SAWMILLING

The sawmilling industry is well established in Australia. Considerable expansion took place in this industry during and since the war, and machinery now installed is believed to have a capacity in excess of log supply.

The extent to which further development of the industry takes place in Australia depends primarily upon the extent of Australia's forest resources, on which sawn timber makes the principal drain. Unfortunately, reliable information is not yet available to determine the maximum annual production of indigenous timber compatible with timber conservation. Extensive roadmaking and the provision of additional logging equipment and transport facilities are also essential to fully develop new areas, which to a large extent will be needed to maintain production by replacing more accessible "cut-out" regions.

The setting up of sawmills in new areas and the closure of existing mills in other localities is, of course, consequent upon a change of importance in timber-producing regions. For instance, in the next decade, the maturing plantations of softwoods in the south-east of South Australia should considerably increase its significance as a timber-producing region, and this will compensate to some extent for the decrease in the supplies of hoop pine in Queensland. However, a large number of firms and individuals experienced in timber production in Australia are constantly endeavouring to acquire additional forest areas, or greater volume of log supplies, and are thought to be competent to convert into sawn timber the quantities of logs likely to be made available.

Output from sawmills consists mainly of timber for building and construction, case-making, timber for seasoning and for finishing into dressed or manufactured products. The greatest proportion of building timber consists of sizes required for dwelling construction. Palings and pickets are of minor importance, and are generally produced from off-cuts. Shingles are seldom produced in Australia.

The supply of sawn timber (including sawn sleepers, and superficial equivalent of plywood

and veneers) since 1938-39 is shown in the following table (note—imports include sawn equivalent of imported logs)—

TIMBER				Apparent	
SUPPLY: Production				Exports	Imports Consumption
(millions of superfeet)					
1938-39	.	.	717	58	323 982
1939-40	.	.	759	49	260 970
1940-41	.	.	827	47	96 876
1941-42	.	.	915	36	60 939
1942-43	.	.	869	12	32 890
1943-44	.	.	868	5	44 907
1944-45	.	.	842	10	92 924
1945-46	.	.	895	12	113 997
1946-47	.	.	1,049	15	125 1,160
1947-48	.	.	1,121	25	143 1,240
1948-49	.	.	1,188	42	237 1,384
1949-50	.	.	1,206	45	248 1,410

Source—Forestry and Timber Bureau—Tariff Board Enquiry, 1950.

Local production of sawn timber in 1950-51 was not appreciably different from production in 1949-50. Imports of sawn timber, however, in 1950-51, rose to about 400 million superfeet. Production in 1951-52 is believed to be substantially higher than in 1950-51.

It will be seen that about 75 per cent. of sawn timber at present used in Australia is supplied from local sources.

Exports consist of sleepers and roundwood (logs, piles and poles) principally to New Zealand and of sawn timber, to United Kingdom, New Zealand and South Africa.

Imports—almost all softwoods—come chiefly from Canada, U.S.A., Scandinavia (mainly Sweden), New Zealand and Brazil. Hardwoods are imported mainly in log form from British Borneo.

Australia's main deficiency in local timbers is in softwoods—these representing in 1949-50 only about 20 per cent. of sawn timber from native logs. The present supply of sawn timber is adequate to demand, and certain imported timbers are even in oversupply. This has resulted from the reduced level of building activity.

DRESSED TIMBER

For 1949-50 floorboard production was 83 million superfeet, of which 11.5 million superfeet was of imported timber; 1948-49 production was 79 million superfeet, of which 9 million superfeet was of imported timber.

Weatherboard production for 1949-50 was 24 million superfeet, of which 2.8 million superfeet was of imported timber; 1948-49 production was 20 million superfeet, of which 2.5 million superfeet was of imported timber.

Architraves, skirtings and mouldings produced in 1949-50 amounted to 27 million superfeet; 1948-49 production was 23 million superfeet.

In addition to the products stated above, other dressed timber to the extent of 55 million superfeet was produced in 1949-50; production in 1948-49 was 50.5 million superfeet.

Imports of dressed timber were 32.7 million superfeet in 1949-50 and 22.5 million superfeet in 1948-49. Imports are mainly from Sweden.

The rate of production of dressed timber in Australia is dependent upon the availability of seasoned timber. Dressing capacity already installed is believed to be adequate, but modernisation of plant will be necessary from time to time. New capacity will be required in new, developing areas.

ACTIVITIES ASSOCIATED WITH SAWMILLING

Where undertaken in Australia, the treatment of timber by immunisation and seasoning are associated with sawmilling activities.

IMMUNISATION: Legislation has been introduced in New South Wales and Queensland requiring the immunisation of timbers against attack by *Lyctus* borer. Sawmillers are extending the use of such treatment, which has enabled the milling of large quantities of timber formerly considered unsuitable.

SEASONING: The output of seasoned timber is below requirements, principally because the demand for all classes of sawn production is so active that stocks cannot be built up in sufficient quantities to permit existing seasoning plants to attain capacity output. New kilns will probably be installed near the localities that are to be developed as centres of

future production of sawn timber. The knowledge, experience and capital to enable the changes are considered to be available.

PRESERVATION: There is only limited industrial experience in Australia in the preservation treatment of timber of low natural durability. Some technical difficulties in achieving satisfactory penetration of preservatives into Australian hardwoods have yet to be overcome. The establishment of treating plants of this nature would benefit the timber industry. This would lessen the effect of the decline in supply of timber species of high natural durability, required for the production of sleepers, poles, piles, fenceposts, mining timbers, etc., by enabling the use of species of lower natural durability.

CASE AND BOX MILLS

Butter, fruit and general-purpose boxes, cases and crates are manufactured both from Australian and imported timbers. The production of case stock provides an outlet for much material that cannot be readily converted into building and manufacturing timber. Plants for the manufacture of shooks and cases have ample capacity to meet the industry's requirements. Furthermore, some makers had by 1951 found it necessary to curtail activities,

due, it is claimed, to price competition from imported shooks (mainly from Sweden) and the extended use of fibreboard containers; the latter trend is thought likely to continue.

During 1949-50, 3.6 million butter boxes and 22 million fruit cases were produced, and in 1948-49, 5 million butter boxes (including shooks) and 23 million fruit cases (including shooks).

PLYWOODS AND VENEERS

The production capacity of veneer and plywood mills established in Australia is about 260 million square feet (3/16 inch thick basis) of plywood a year. This capacity is considerably in excess of actual production, which is currently estimated to be in the region of 160 million square feet a year. Local production is now adequate to demand, which has fallen in the last twelve months.

Small quantities of plywood, and of special quality veneers, were imported into Australia prior to the 1939-45 War, but, owing to shortages in the postwar period, larger quantities have been imported. During 1949-50 such im-

portations were 24.6 million square feet of plywood, and 6.5 million square feet of veneers.

Small quantities of special veneers (for example, walnut) are exported, but the possibilities of developing export markets are likely to be restricted by the limited output of such special types.

Overseas plywood manufacturing techniques which do not appear to be fully developed in Australia include the general use of hot-press methods and the application of high-frequency electronic heating in glueing operations.

WALL AND CEILING BOARDS

Fibreboard production is undertaken at present by three firms, two of which produce hardboard, and the other, hardboard and softboard.

A corestock for veneered panels is also produced from a sawdust-resin mixture.

The degree to which full production of these plants would meet the demand for these mate-

rials is not yet established. However, active current interest in the possible production of various types of wallboards from waste products, suggests that expansion is likely to occur in this field to the limit of available markets.

The current use of locally manufactured and imported fibreboards is about 125 million square feet a year.

Apart from asbestos-cement sheets, plaster

JOINERY

The Australian joinery industry is well established in both country and metropolitan centres, producing a full range of joinery products. Most items of joinery, including doors

and windows, are available, and selling competition is keen, notwithstanding the high level of demand for builders' requisites and associated joinery items.

CASKS AND BARRELS

The existing cooperage works in Australia are believed to be equipped to meet the demand for casks and barrels, but the liquor trade (the principal user) has certain technical requirements that are difficult to fulfil with Australian timbers. Suitable imported timbers

are somewhat difficult to procure from overseas. A shortage of skilled "splitters" is at present restricting production in this field.

The growing trend towards metal and other non-wooden containers appears likely to have an adverse effect on this industry.

BROOMS AND BRUSHES

The manufacture of brooms and brushware is well established in Australia, with factories operating in all States. The industry produces a wide diversity of brooms, mops, dusters, personal, household and industrial brushes, and carpet sweepers. During 1949-50 the value of output amounted to £3,246,000, and in 1948-49 to £2,786,126. Exports are insignificant.

A major difficulty experienced in this industry is the obtaining from China of adequate supplies of high-quality hog bristles, used in the manufacture of paint brushes.

Imports of brooms, brushes, etc., have not been insignificant for some types in recent years. Details for 1948-49 and 1949-50 are as follows—

IMPORTS:	1948-49		1949-50	
	doz.	£	doz.	£
Brooms, whisks ..	—	470	—	396
Brush sets for halls, etc.	—	309	—	27
Carpet sweepers ..	—	25,513	—	41,828
Mops	—	1,899	—	2,631
Scrubbing brushes ..	—	5,805	—	1,201
Clothes brushes ..	1,697	5,872	3,900	9,451
Hair brushes .. .	12,979	61,376	16,551	58,405
Nail brushes .. .	—	2,791	—	11,565
Shaving brushes ..	—	35,402	—	27,318
Tooth brushes .. .	7,357	3,583	7,105	5,080
Other toilet brushes	—	1,152	—	3,300
Artists' brushes ..	—	45,247	—	48,551
Brushes for school-work	—	6,363	—	1,664
Paint and varnish brushes	4,266	11,571	4,052	26,547
Brushes with metal bristles	—	16,027	—	15,686
All other brushes ..	—	36,495	—	35,579
Totals	—	259,875	—	289,229

MATCHES

The Australian match industry is well established and efficiently operated. It produces safety matches of wood and of paper, also wax and waterproof matches. The latter are distributed almost exclusively to areas where safety matches are affected by climatic conditions.

Production of wood safety matches in 1948-49 was 3,250,000 gross boxes, valued at £1,054,198; and in 1949-50, 3,580,266 gross boxes, valued at £1,233,575. Details of the production of paper safety matches, wax and wax waterproof matches are not available.

Imports and exports of matches are small. During 1949-50 imports were 17,489 gross boxes, and exports, to Fiji and New Zealand, 123,988 gross boxes. In 1948-49 imports—mainly from Hong Kong—were 108,067 gross boxes, while for the same period, exports to British and French possessions in the Pacific were 106,089 gross boxes.

The industry has the machine capacity to increase output.

In the past, the main problem confronting the industry was splint production. The most suitable Australian timbers were not available in adequate quantities to meet requirements. Shortages of dollar currency limited imports from Canada, and match splints were being imported from Finland, U.S.S.R. and Italy. Dollar restrictions still operate, but supplies of local timber are now freely available.

Two manufacturers operate separate plants for the production of veneers for match splints and boxes. Additional veneers are purchased from two producers, who also make veneers for other purposes.

Most chemicals used in the industry are obtained from local sources. Red phosphorus and paraffin wax are imported.

WOOD-WOOL

Wood-wool is chiefly used as a packing for fruit and similar products, and also with a cement binder to produce wallboards. There does not appear to be an unsatisfied demand for

wood-wool at present, but its use could be extended considerably, especially by the Queensland fruit industry for packing tropical fruits.

WOOD-FLOUR

Wood-flour is mainly used as a filler in linoleum and plastics-moulding powders. No figures are available concerning its production, but supplies are believed to be below

local demand. A new company to make wood-flour has been formed and expects to be in production by early 1953. (For cork-flour, see "Cork", later.)

UTILISATION OF WASTE FROM SAWMILLS, etc.

The problem of economically using sawmill waste has been the subject of intensive research in most countries, including Australia, where in addition to its direct use as a fuel in steam-powered sawmills, or as an absorbent, etc., it is used as a basic raw material for wood-flour production, and for the manufacture

of a wallboard. Investigations by local firms are also proceeding into its use for the manufacture of sawdust briquettes, and for other products, which, overseas, are made from sawmill waste. The possible use of other waste materials (e.g., bagasse) is also receiving attention.

MISCELLANEOUS WOOD PRODUCTS

Products classified under this heading include such items as turned components for the furniture and similar trades, tool and other handles, textile woodware, fruit baskets, patterns of wood, parquetry, and numerous minor items.

No detailed information as to the supply position of each individual item is available, but, generally speaking, it is believed that the demand for most products is being met with reasonable adequacy.

CORK PROCESSING

The cork tree is indigenous to a few countries near the western end of the Mediterranean. Except for U.S.A., cultivation elsewhere, including Australia, has not yet produced commercial quantities. Processing in Australia, therefore, is dependent on importation, mostly from Portugal and Spain, of scrap cork and selected corkbark shavings and waste.

Of the total annual imports (about 5,000 tons), about 95 per cent. is further processed in Australia. Of this quantity possibly 10 per cent. is exported to Malaya, New Zealand, South Africa, India, Singapore, the Philippines, etc.

Processes undertaken in Australia include milling, pressing and baking, slitting, cutting, punching and stamping. Products which result from one or more of these processes are insulation corkboard and lagging, agglomerate or compressed corksheets, granulated cork, bottle corks, wads (discs), cots and rollers, strips, fishing floats, washers and gaskets, lifebuoys, floor tiles, table mats, shoe platforms, heels, etc.

Australian capacity for processing cork is reported to be more than adequate to meet demand for some products, but short for other products.

INSULATION CORKBOARD AND LAGGING: Four firms make this type of product from various grades of scrap. Sufficient capacity exists to meet the Australian demand but there is no accumulation of stock. A small percentage (which with more capacity and labour could be increased), is exported, and a small percentage is imported.

GRANULATED CORK: Sold by millers and cutters as required for packing hot water services, export fruit, etc.

CROWN SEALS: Discs are cut from moulded rods made by one firm by the lower baking temperature process. A number of other firms make crown seals by different processes. Capacity is in excess of local requirements.

COTS AND ROLLERS: Moulded by lower temperature process and also stamped from compressed sheet. Capacity is adequate.

COMPRESSED CORK SHEET AND STAMPINGS: From better-quality imported cork; one major manufacturer makes the bulk of Australian needs of compressed cork sheet. In addition to supplying the Australian market, an export trade has been developed, but recent difficulties in obtaining shipments of cork scrap have lately temporarily restricted production. The company also stamps out liners, rings, cots, table mats, floor tiles, shoe platforms, etc. Gaskets are cut from sheet by several firms.

BOTTLE CORKS: About 30 per cent. of Australia's requirements are prepared in Australia by not more than three firms, comparatively high labour costs making the price of overseas bottle corks attractive to many users. Complexity of requirements explains the inadequacy of Australian capacity.

FISHING-NET FLOATS are cut from natural bark by three firms complementarily to other products such as bottle corks, winders, etc. Capacity is adequate.

CORK-FLOUR: Principal use is for incorporation in linoleum manufacture, and the one firm using it grinds most of its requirements. In this regard experimentation is proceeding to reduce an indigenous "paperbark" (*Melaleuca*) bark to a suitable flour (see "Wood-flour", earlier).

TANNING BARK

The bark principally used in Australia for tanning purposes is from several species of wattle (*Acacia*). Mallet bark, from *Eucalyptus astringens*, is next in importance. (See Chapter 6 for comment on manufacture of vegetable tannin and of tanning extracts.)

In 1948-49, Australian production of tanning bark totalled 12,441 tons, while imports were 1,384 tons. In the following year, 1949-50, production declined to 4,745 tons, and imports were 1,073 tons. The supply of tanning bark available is insufficient for Australian tanning requirements.

The chief reason for the deficiency in supply of Australian bark is shortage of labour. Normally, the bark is stripped by individual strippers under contract to local agents for the tanners and merchants. The work, which is done principally in rough bush country, is arduous, and living conditions are usually primitive. While more attractive employment at high wages is readily available, fewer strippers are inclined to continue. Even with higher rates offering, very little more bark has been forthcoming and the tanners have been forced to turn increasingly to tanning extract, much of which is imported.

STRAW PRODUCTS

STRAW ENVELOPES are used as a packing material for bottles in the wine and spirit trade. Australian production is estimated at from 50 to 55 million envelopes a year. Australian demands are fully met, and there are no imports of this commodity. There is a small export trade, mainly to New Zealand.

STRAW INSULATING-BOARD: An insulation board composed entirely of straw (mainly wheaten) bound with galvanised wire is made in Australia. The board is also used for low-pitched roofs (and covered with bituminous felt) and occasionally used as a cement-rendered wallboard. Plant capacity for the product appears to be adequate.

FURNITURE

The manufacture of all types of furniture wholly or mainly of wood, or wooden framed, has been established in Australia for many years, and present plant capacity is more than adequate to meet Australian requirements. Ample supplies of furniture are available on the Australian market. There is no significant import or export of furniture into or from Australia.

The industry makes a wide range of items of household, office and other furniture (for theatres, public buildings, etc.) in a wide range

of quality and price. The value of all types of wood or wooden-framed furniture produced in 1948-49 was £14.3 million, and in 1949-50, £17.5 million. Other items produced by this industry were—

PRODUCTION:	1948-49	1949-50
	no.	no.
Wireless cabinets	82,444	75,895
Billiards tables	114	146
Ice chests—		
Wood, metal lined	21,230	18,528
All metal	20,820	16,039
Cots	11,365	10,794

PERAMBULATORS, BABY CARRIAGES, NURSERY FURNITURE, PICTURE FRAMES

The foregoing comments as to the established position of the furniture industry in Australia are also applicable to allied fields of specialised activity such as the manufacture of

perambulators, baby carriages, nursery furniture and picture frames. Production is, in general, adequate to demand.

WICKER FURNITURE AND BASKETWARE

Established capacity for the manufacture of wicker furniture and basketware is considerably in excess of production, which is experiencing shortages of labour and materials. However, the demand for wicker furniture has fallen off considerably, because of the change in consumers' tastes for this type of product. The value of seagrass and wicker furniture, etc., produced in 1949-50 was £168,937.

The industry is dependent upon imports of

cane from Malaya, Hong Kong, Singapore, etc. Queensland supplies of cane are sometimes available, but are inferior to the imported material, because texture is too stiff for ordinary working.

Seagrass furniture is limited in output because cane furniture is the more preferred of the two. The only seagrass products now made, generally speaking, are commode chairs and invalid chairs.

HAIR TREATMENT FOR UPHOLSTERING AND BRUSHMAKING

The animal hair treated in Australia for upholstery and brushmaking is all obtained from Australian sources. No production figures are available. Imports of curled hair suitable for upholstery in 1948-49 were 7,000 lbs., and in 1949-50, 2,240 lbs. It seems that Australian firms are meeting the demand in this field.

Some processing of human and animal hair for the brushmaking trade is done by the hair-treatment firms, though many of the brush-makers treat hair for bristles in their own factories. Figures of Australian production of hair bristles, etc., are not available. Imports in 1948-49 and 1949-50 were—

IMPORTS:	1948-49	1949-50
	cwt.	cwt.
Bristles of animal origin	2,442	2,550
Brushmakers' drafts of horse hair and cow hair	10	—
Bristles of vegetable fibres	223	51
Other fibres mainly used in brush- making	2,580	3,014
Totals	5,255	5,615

It seems that production of bristles in Australia is not sufficient to meet the requirements of the brushmaking trade. Bristles are scarce at present. (The preparation of hair for use in the manufacture of hard hair felt and needled jute/hair felt is discussed in Chapter 15, "Textiles, Felting, Cordage".)

Part Three: Basic Statistics

COMPARATIVE STATISTICS, 1938-39/1949-50

NUMBER OF ESTABLISHMENTS AT 1938-39 AND 1949-50

NUMBER OF EMPLOYEES AT 1938-39, 1949-50, JUNE 1950, SEPTEMBER 1951

Activity (Statistical Sub-classes used by Commonwealth Statistician, 1949-50)	Establishments		Employees			
	1938-39	1949-50	1938-39	1949-50	June 1950 (a)	Sept. 1951 (a)
Sawmills (b)	no. 1,610	no. 2,711	no. 17,707	no. 29,008	no. 23,643	no. 23,537
Boxes and Cases (c)	189	360	2,650	4,661	4,507	4,178
Plywood Mills (including Veneers)	(c)23	46	(c)1,349	2,430	2,529	2,625
Wall and Ceiling Boards (not Plaster or Cement) (d)		11		767	740	811
Joinery (f)	626	1,126	5,473	11,524	9,395	9,561
Cooperage	45	48	720	774	658	730
Brooms and Brushes (g)	70	103	1,587	2,125	2,131	2,234
Matches	6	5	1,023	1,024	1,004	980
Picture Frames (h)	31	39	274	319	294	272
Woodturning, Woodcarving, etc. (j)	219	338	1,785	2,869	2,554	2,506
Bark Mills (k)	21	23	48	55	25	18
Other (of Class X) (l)	(m)23	20	(m)252	210	60	54
Cabinet and Furniture Making (including Billiard Tables and Upholstery) (n)	880	1,379	11,576	15,775	14,178	14,532
Perambulators (including Pushers and Strollers) (o)	(p)19	44	(p)294	443	384	405
Basketware, Wickerware (including Sea-grass and Bamboo Furniture)	(p)41	63	(p)461	428	313	311
Totals (q)	3,809	6,316	45,199	72,412	62,415	62,754

STATISTICAL SUMMARY, 1949-50

EMPLOYMENT, MALE AND FEMALE

SALARIES AND WAGES PAID, IN TOTAL AND PER PERSON ENGAGED

VALUE OF PRODUCTION

VALUE OF MATERIALS, POWER, FUEL, REPAIRS, etc.

VALUE OF OUTPUT

See Explanations,
Appendix IV

Activity (Statistical Sub-classes used by Commonwealth Statistician, 1949-50)	Employment			Salaries and Wages Paid		Value of Pro- duction	Value of Materials, Fuel, etc. Used	Value of Output
	Males	Females	Persons	Total	Per Person Engaged			
Sawmills (b)	no. 28,242	no. 766	no. 29,008	£'000 10,997	£ 379	£'000 18,994	£'000 25,806	£'000 44,750
Boxes and Cases (c)	4,487	174	4,661	1,822	391	2,780	4,344	7,124
Plywood Mills (including Veneers)	2,171	259	2,430	1,020	420	1,759	1,935	3,694
Wall and Ceiling Boards (not Plaster or Cement) (d)	735	32	767	372	485	991	855	1,846
Joinery (f)	11,141	383	11,524	4,656	404	7,408	8,457	15,865
Cooperage	764	10	774	372	481	512	383	895
Brooms and Brushes (g)	1,444	681	2,125	768	361	1,342	1,904	3,246
Matches	449	575	1,024	384	375	541	792	1,333
Picture Frames (h)	224	95	319	111	348	173	115	288
Woodturning, Woodcarving, etc. (j)	2,519	350	2,869	1,065	371	1,965	1,617	3,582
Bark Mills (k)	55	—	55	14	254	24	83	107
Other (of Class X) (l)	156	54	210	87	414	207	184	391
Cabinet and Furniture making (including Billiard Tables and Upholstery) (n)	14,857	918	15,775	5,871	372	9,538	10,106	19,644
Perambulators (including Pushers and Strollers) (o)	373	70	443	155	350	296	369	665
Basketware and Wickerware (including Sea-grass and Bamboo Furniture)	405	23	428	149	348	247	179	426
Totals (q)	68,022	4,390	72,412	27,843	384	46,777	57,129	103,856

Explanatory Footnotes to Both Tables

- (a) These employment figures are taken from monthly payroll-tax returns and differ slightly from the other employment figures, which are supplied on annual factory returns.
- (b) Also includes dressing and mouldings; and firewood mills where classifiable as a factory.
- (c) Also includes associated sawing of case material.
- (d) Also includes board made of compressed straw for insulating and building purposes.

- (e) The statistics are for the sub-class entitled "Plywood Mills, etc.". At 1938-39, the present sub-class "Wall and Ceiling Boards (not Plaster or Cement)" was unidentified and comprised part of the sub-class "Other" of the Commonwealth Statistician's Class X, then entitled "Woodworking and Basketware".
- (f) Also includes shop and office cases and fittings; ladders; coffins.
- (g) Also includes toothbrush manufacture.
- (h) Also includes mirror frames.
- (j) Also includes wood pipe; marquet and parquet; pattern making; dowels and skewers; clothes pegs; lattice; laths; match splints, match boxes, ice-cream spoons and sticks, punnets and fruit baskets; products of compressed impregnated wood; models of wood; incubators and brooders of wood; home butter-churns; clock cases of wood; tool and broom handles; flower stakes; wood pulleys; bobbins; rifle furniture; coat hangers; smoking pipes.
- (k) Grinding of tan barks.
- (l) The sub-class "Other" is one of miscellaneous activities not elsewhere covered within the Commonwealth Statistician's Class X, "Sawmills, Joinery, Boxes, etc., Woodturning and Carving". The sub-class includes wood-wool; wood-flour; cork processing and cork products; poker work.
- (m) Also includes wall and ceiling boards not of plaster or cement—see footnote (e) above.
- (n) Also includes hair curling and associated hair processing for upholstering and brushmaking trades; and includes ice-chests (wooden framed and sheathed).
- (o) Also includes manufacture of imitation wicker.
- (p) Establishments in Tasmania classifiable within the sub-class then entitled "Perambulators" were included in the sub-class then entitled "Basket and Wickerware, Seagrass and Bamboo Furniture".
- (q) Consideration and comparison of totals must take into account the effects stated in footnotes explaining the composition of certain sub-classes and figure units.

Chapter 4:

PULP

PAPER

PAPERBOARD

Part One: Structure of Established Manufacturing Activities

THE making of pulp, paper and paperboard in Australia is an industry limited to eight manufacturers, largely complementary to one another in their activities. Expansion now under way by the existing manufacturers and establishment of mills by three new manufacturers will continue in the main the complementary pattern. The statement of structure of the industry provided in this Part is detailed, but should not be taken as being necessarily complete in that detail.

The industry at mid-1952 operated twelve mill establishments and employed about 6,800 persons. The eight largest mills (five of which are owned by one company) collectively employ about 96 per cent. of total employment of the industry and produce about 98 per cent. of the tonnage of paper and paperboard made by the industry. A summary of the industry is as follows—

Location of 12 Mills	Company	Estimated Employment, 1952 (a)
New South Wales—		
Botany (Sydney)	Australian Paper Manufacturers Ltd. ..	About 2,000
Alexandria (Sydney)	Bernard Lawrence Pty. Ltd.	About 100
Victoria—		
Maryvale	Australian Paper Manufacturers Ltd. ..	About 1,300
Fairfield (Melbourne)	Australian Paper Manufacturers Ltd. ..	About 900
South Melbourne	Australian Paper Manufacturers Ltd. ..	About 350
Broadford	Australian Paper Manufacturers Ltd. ..	About 250
Footscray (Melbourne)	Ernest Nelson Pty. Ltd.	About 60
Queensland—		
Herston (Brisbane)	Cardboards Pty. Ltd.	Less than 50
South Australia—		
Snuggery (Millicent)	Cellulose Australia Ltd.	About 250
Western Australia—		
Bayswater (Perth)	Western Paper Mills Ltd.	Less than 50
Tasmania—		
Burnie	Associated Pulp & Paper Mills Ltd. ..	About 1,000
Boyer	Australian Newsprint Mills Ltd.	About 500

(a) Estimates of factory employment at each mill, made by the Division of Industrial Development.

Details of mill establishments and products, by companies, are set out below. Details of firm expansion projects by established companies and details of three new manufacturers are included.

FOUR MAIN MANUFACTURERS—

Australian Paper Manufacturers Ltd. operates five mills (a sixth in course of construction), and employs about 70 per cent. of all factory employees engaged in paper and paperboard manufacture in Australia. The company is not associated with any other company making paper or paperboard in Australia. A.P.M. Ltd. is an operating company. All its ordinary shares and portion of its preference shares are owned by a holding company, The Australasian Paper & Pulp Co. Ltd., a public company. (It was announced in July, 1952, that arrangements were being made to invite the shareholders of both companies to merge the two companies into one.) The A.P. & P. Co. Ltd. represents, in effect, the merger at various times since 1921 of the shareholdings of three operating companies—Australian Paper Mills Pty. Ltd. (mills at Melbourne, Fyansford, Broadford, Fairfield, all in Victoria), Sydney Paper Mills Co. Ltd. (mill at Botany, N.S.W.), and Cumberland Paper Board Mills Ltd. (mill at Lane Cove, N.S.W.). The Commonwealth Board Mills Ltd. (mill at Abbotsford, Vic.) was purchased in 1927. The Fyansford mill was closed and

PAPERBOARDS and PAPERS made—

PAPERBOARDS: For corrugated-fibre and solid-fibre containers—kraft-liner, kraft corrugating paper, cylinder (jute) liner, filler-board, cylinder kraft-board. For cardboard boxes and cartons—plain chipboard, plain semi-bending straw-board, white- and coloured-lined chipboard, bleached lined greyboard, machine-coated grey-back, M.G. patent white-lined manilla and M.G. patent white-lined grey-board. For waxed containers—waxing cartridge. Miscellaneous boards—tag and document manillas, ticket boards, lined and unlined plaster-liner boards (for gypsum wallboard), cone board (for textiles tubes and cones), tube-winding chipboard, woodpulp board.

PAPERS FOR WRAPPINGS, BAGS AND PROCESSING: Brown, bleached and coloured M.G. kraft; M.F. and crepe kraft; natural and coloured

dismantled in 1922, the Lane Cove mill was destroyed by fire in 1928 and not re-established, and the Abbotsford mill plant was removed to the South Melbourne mill at purchase. The Melbourne, Fairfield, Broadford and Botany mills were retained, the two sections of the Maryvale mill were established in 1938-40 and a sixth mill is now being established at Petrie, near Brisbane, Queensland. Details of A.P.M. Ltd. mills are as follows—

MARYVALE MILL (Vic.), PULPMILL SECTION, kraft process, using eucalypt pulpwood mainly, and plantation-pine. Pulpwood is obtained from Crown lands, private lands and A.P.M.'s. freehold lands. Pulpmill provides paper pulp in slush form to the papermill (see next listing) integrated with pulp-mill, and laps the remaining pulp for transport to Botany and Fairfield mills. Output for 1951-52 was 47,500 tons, 6,000 tons of which were full bleached, and 4,000 tons semi-bleached. Extensions now well under way will increase capacity to 67,000 tons a year at early 1953, with capacity to bleach a sizable portion of output. An electrolytic chlorine and caustic-soda plant is in course of construction.

MARYVALE MILL (Vic.) PAPERMILL SECTION, with one M.F. paper machine used for kraft wrappings, kraft-liner and kraft corrugating paper. Output for 1951-52 was 32,000 tons. An M.G. paper machine for machine-glazed papers is now being installed, and will add 15,000 tons to mill capacity at late 1953.

BOTANY MILL (Sydney, N.S.W.), with six machines. Supplementary plant includes small groundwood-pulp plant, straw-cooking plant, embossing plant. Materials used are woodpulp (chemical and mechanical), wastepaper, plantation-pine pulpwood; straw is used at times. Paper machines comprise two combination M.F./M.G. machines and one M.G. machine. Board machines comprise three cylinder machines, one of the three being equipped with M.G. cylinder and machine-process coating unit and is used for specialty boards. Output of mill for 1951-52 was 66,000 tons, comprising 13,500 tons of papers (wrappings, processing papers, lithographic printings, crepe towelling) and 52,500 tons of boards (container, carton and box boards, cone board, plaster-liner). Conversion of the M.G. paper machine to make crepe toilet tissues is proposed.

FAIRFIELD MILL (Melbourne, Vic.) with four machines. Supplementary plant includes straw-cooking plant and a hydropulper unit. Materials used are woodpulp (chemical and mechanical) and wastepaper; straw is used at times. Paper machines comprise one M.F. machine, one M.G. machine. The board machines comprise one cylinder machine of the ordinary type and one cylinder machine making M.G. boards (this latter machine began production in June, 1952, and adds 15,000 tons a year to mill capacity). Output of the mill for 1951-52 was 40,500 tons, comprising 23,000 tons of paper (wrappings, bag paper, M.G. lithographic printing), and 17,500 tons of boards (box and carton boards, ticket boards, plaster-liner boards).

BROADFORD MILL (Vic.), with one cylinder board machine and straw-cooking plant. Output of mill for 1951-52 was 12,000 tons, comprising plain strawboard of semi-bending grades and plain chipboard, both of mixed furnishes of wastepaper and cereal straw. Supplementary plant installed, in 1952, comprises a wastepaper breaker and a paster for solid-fibre container board. (A plant for making up solid-fibre containers is now (mid-1952) being installed.)

MELBOURNE MILL (South Melbourne, Vic.), with two machines. Materials used are woodpulp (chemical and mechanical), wastepaper, rags and bags. Machines comprise a cylinder machine which also has a wire section used for paper-felt manufacture, and a small paper machine. Output of mill for 1951-52 was 9,500 tons, comprising 4,000 tons of lined and plain chipboards, 1,500 tons of cover papers, blotting, duplicating, filter, and other specialty papers, and 4,000 tons of paper felt. A small plant for polyethylene coating of paper has been established at this mill, and production on a semi-commercial scale has begun. (The embossing plant at the Botany mill is to be shifted to the Melbourne mill.)

PETRIE MILL (near Brisbane, Qld.), now being erected. Will comprise one cylinder board machine. Materials to be used will be wastepaper and possibly hardwood pulpwoods of Queensland origin. Output of mill is expected to be 20,000 tons of box, carton and container boards a year, at early 1954.

M.G. sulphite; base papers for laminating (bituminised linings, paper-based plastics laminates, etc.), envelopes, multiwall bags, gumming (kraft gummed tape), waxing, abrasives coating, paper spinning, electrical-wire insulating paper.

PRINTING PAPERS: M.G. litho.

MISCELLANEOUS PAPERS: Blotting covers and pressings; duplicating; crepe towelling; paper felt (for under-felting floor coverings, for bituminised roofing and flooring felts, anti-drumming felt, cartridge wads, etc.); filter.

PROCESSED PAPERBOARDS AND PAPER: Solid-fibre container board; pasted chipboard; pasted strawboard; embossed cover papers; supercalendered M.G. papers; polyethylene-coated paper. (Brush-coated papers and boards—coated litho, coated grey-boards, chromo boards, surface-coated boards—were made until 1951, when the coating plant was sold to a company specialising in coated boards and cover papers—see A.P.M. Ltd., below.)

(CORRUGATED-FIBRE AND SOLID-FIBRE CONTAINER BOARDS AND FIBREBOARD CONTAINERS: A.P.M. Ltd. has an equal interest with a group of wooden-case manufacturers in a large and modern plant owned and operated by Fibre Containers Pty. Ltd., and situated adjacent to A.P.M.'s Botany mill; the plant is engaged in corrugating and pasting of container boards and the making up of containers therefrom. A second plant, wholly owned by A.P.M. Ltd., to make corrugated board and containers therefrom, is being established at Clayton, Melbourne, Vic. A third plant, to make solid-fibre boards, pasted chipboard and pasted strawboard, and solid-fibre containers, is being established at A.P.M.'s Broadford mill, Vic.)

Output of the A.P.M. mills for 1951-52 was 160,000 tons (8 per cent. greater than the previous year and 78 per cent. greater than 1939), comprising 90,000 tons of boards and 70,000 tons of papers, from six cylinder machines and seven paper machines. (Tonnage does not include

processed paperboards and paper, which are the product of secondary operations, and were included in the primary tonnage when in an unprocessed condition.) The kraft pulpmill output was 47,500 tons, 6,000 tons of which were fully bleached and 4,000 tons semi-bleached. All mills were worked throughout the year at full running—which comprised three continuous shifts over five days, together with overtime for portion of the two weekend days.

When the present expansion programme is completed, including proposed extensions, total A.P.M. annual capacity at normal three-shift running will be about 215,000 tons a year, comprising 130,000 tons of board and 85,000 tons of paper, from eight cylinder machines and eight paper machines. The kraft pulpmill capacity will be 67,000 tons a year, with bleaching capacity of sizable extent. All other capacity for making woodpulp—mechanical and semi-chemical—will be 20,000 tons. The company will require, in addition, considerable quantities of imported chemical and mechanical pulp, very large quantities of wastepaper, and a relatively small amount of straw, rags and bags.

A.P.M. Ltd. has three wholly-owned subsidiary companies related to its pulp, paper and paperboard manufacturing activities. **Maddingley Brown Coal Pty. Ltd.** (in which the company bought a controlling interest in 1947) owns and operates a large open-cut mine near Bacchus Marsh, Vic., for supply of brown coal fuel to the parent company's Melbourne, Fairfield and Broadford mills (Maryvale mill is supplied from the nearby North Yallourn brown-coal open-cut of the Electricity Commission of Victoria) and to other industries, particularly at Melbourne; the mine plant includes large excavators, many large-capacity motor-trucks for haulage to a rail siding, and a large loading station at the rail siding. **A.P.M. Forests Pty. Ltd.**, formed in 1951, is concerned with forestry operations associated with pulpwood supply to the parent company's mill at Maryvale for kraft and high-alpha pulps, and supply of sawlogs to the three sawmills operated by the parent company (including the large sawmill at the Maryvale pulp and paper mill). A.P.M. Forests Pty. Ltd. is engaged in eucalypt logging, and pulpwood cutting in State, private and company forests in Gippsland, Vic., including the provision of extraction tracks and secondary roads; maintenance of the company's eucalypt forests, logging and pulpwood cutting in Victorian and South Australian plantation-pine forests; the mechanical clearing of very large areas in Gippsland, and the mechanical planting of plantation-pine in the cleared areas (20,000 acres by 1957, and 1,500 acres a year thereafter, first pulpwood, in thinnings, by 1962, and full logging about 1966), and operation of an extensive and well-equipped service for fighting forest fires. **Kirkconnell Pty. Ltd.**, formed in 1947, bought and operates a plantation-pine forest near Bathurst, N.S.W., to supply pulpwood to the parent company's Botany mill; it is proposed to absorb Kirkconnell Pty. Ltd. into A.P.M. Forests Pty. Ltd. In addition to the three subsidiary companies described above, and to the three sawmills for building timbers, etc., operated by A.P.M. Ltd., the parent company operates **Langhorne's Creek Salt Works**, near Murray Bridge, S.A., for supply of salt to the Maryvale pulpmill and for general sale; the salt works were bought by the company in 1952. (See close of right-hand column at left describing the products of A.P.M. Ltd. for comment on the company's interests and activities in paper and paperboard converting.)

Associated Pulp & Paper Mills Ltd. has one mill, at Burnie, Tas., and employs about 15 per cent. of all factory employees engaged in paper and paperboard manufacture in Australia. (A subsidiary company, **Thomas Owen & Co. (Aust.) Ltd.**, is establishing a paper mill adjacent to the A.P.P.M. mill—see later this Part One.) The company was established in 1936 by collective action of several of the leading non-ferrous metals companies in Australia, joined by the leading glass-products company; these companies have each retained a considerable shareholding interest. The company has a large area of freehold forest for pulpwood supply, and also draws from State concession and private areas, all near to Burnie.

The mill consists of a soda-pulp (eucalypt) plant and four M.F. paper machines. One machine is equipped for machine process coating, which, however, has not been entered into commercially. Total rated capacity of the mill is 32,000 tons a year (but severe State-wide rationing of electric power which coincided with erection of the fourth machine has prevented rated production being reached).

Pulpmill capacity at present is about 23,000 tons a year, all of which is used at the paper mill in slush form. (Imported pulps are also necessary; an annual quantity of sulphite pulp equal to about 8 per cent. of eucalypt-pulp annual production is required for proportioning the eucalypt furnish to proper strengths for certain papers, and additional quantities of imported chemical pulps are required to make up total tonnage required by A.P.P.M. machines. Pulp imports by A.P.P.M. Ltd. will increase because of extensions of papermaking capacity at the A.P.P.M. mill now under way (see below) and also, on behalf of **Thomas Owen (Australia) Pty. Ltd.**, to meet requirements at the "TOCAL" mill (see later).) Mechanical pulp (groundwood), wastepaper and straw are not used. Pulpmill extensions that will increase output from about 23,000 tons to about 33,000 tons a year have been planned, and initial steps taken.

PAPERS made—

WRITINGS: Woves, lays, bond, bank, ledger.

PRINTINGS: Machine-finished supercalendered, offset, antique.

MISCELLANEOUS PAPERS: Drawing cartridge, duplicating, blotting, base papers for gumming and brush-coating, body paper for true vegetable parchment.

(BRUSH-COATED PAPERS AND BOARDS: Made by two specialist companies, in both of which A.P.P.M. Ltd. has the controlling interest. One of the companies, **Ballarat Paper Mills Pty. Ltd.** (in which **British Coated Paper and Boards Ltd., U.K.**, is a shareholder), at Ballarat, Vic., is principally concerned with coated papers, the other, **Papyrus Pty. Ltd.**, at Sydney, N.S.W., with coated boards and cover papers. See Chapter 5, "Paper Products, Printing, Signwriting, Photographic Materials".)

Output of papers for 1951-52 was 29,000 tons; the mill worked three shifts over five and a half days for the full year. With the return to production of a small machine taken out of use for reconditioning, and provision of additional power generated at the mill, it is expected that 1952-53 output will be close to rated capacity.

A.P.P.M. Ltd. announced in mid-1951 that it had decided to establish a mainland mill, for writings and printings. A site has been purchased at Geelong, Vic., for a two-machine paper mill, to be established as quickly as possible. Pulp would be imported for an initial period of operation, after which both short-fibred pulp (eucalypt) and long-fibred pulp (from plantation-pine) would be available from a pulp mill which the company proposed to build in the Otway Ranges (not far from Geelong). However, because of various hindrances encountered, the company has suspended for the time being its plans for establishment of mainland mills, and has begun erection of additional buildings at the Burnie mill for the two machines ordered for the proposed Geelong mill. Both are M.F. paper machines of the same type and size as the last two machines installed at the Burnie Mill and will add 12,000 to 15,000 tons output a year, according to types of papers that are made. The machines are expected to be in production by late 1954.

(A.P.P.M. Ltd. does its own logging, and cutting of pulpwood and firewood, and is now erecting at Burnie a sawmill for building and furniture timbers, as an integrated activity with the pulp and paper mill; it is expected that production will begin in late 1952. Another integrated commercial wood-utilisation unit is a hardboard and semi-hardboard mill, which is operated by Paper Makers Pty. Ltd., a wholly-owned subsidiary company of A.P.P.M. Ltd.; production of hardboard began in mid-1951.)

Australian Newsprint Mills Ltd. has one mill (at Boyer, Tas.), and employs about 8 per cent. of all employees engaged in paper and paperboard manufacture in Australia. A.N.M. Ltd. was established as a proprietary company by a group of Australian daily newspaper companies in 1938; at conversion to a public company in 1948 those companies retained their shareholdings (collectively substantial) and are the principal users of newsprint made at the mill.

PAPER made:
Newsprint

The mill comprises a groundwood-pulp (eucalypt) plant and two newsprint machines—a 162-inch and a 232-inch with annual capacities of about 30,000 tons and 45,000 tons. The latter machine was ready to begin production in mid-1951, but severe power restrictions in Tasmania have to date (mid-1952) prevented its use other than in short "maintenance" runs, thereby reducing output to 40 per cent. of mill capacity. Production for 1951-52 was 32,643 tons; the mill worked three shifts over seven days a week for the full year, stopping only for maintenance. Pulpwood is drawn from State concession areas.

Annual requirements of long-fibred pulp for proportioning the eucalypt groundwood pulp, at full output, is about 16,000 tons. At present the long-fibred pulp is imported from Canada mainly (sulphite) and Sweden (sulphate), but it is expected that by late 1953 delivery of sulphate pulp will begin from N.Z. Forest Products Ltd.'s plantation-pine pulp mill (at Kinleith, New Zealand), which A.N.M. Ltd. has helped to finance (by loan guarantee), the supply initially to be 12,500 tons a year.

(A small sawmill, supplying timber mainly for joinery and small mass-produced wood products, is operated as an integral part of A.N.M. Ltd.'s logging activities.)

Cellulose Australia Ltd. has one mill (near Millicent, S.A.), and employs about 4 per cent. of all employees engaged in paper and paper-board manufacture in Australia. The company is not associated to a major degree with other companies in or out of the paper and paper-board industry. The mill comprises a groundwood-pulp (plantation-pine) plant and one board machine. Pulpwood is drawn from State and other plantations not owned or operated by the company. Wastepaper and straw are used, also a small tonnage of imported long-fibred chemical pulps. Output of boards is about 9,000 tons a year.

PAPERBOARD made:

Cylinder-liner (jute), unlined and lined chip, unlined strawboard, white-lined manilla board, document and tag manillas, triplex boards, non-bending woodpulp board.

FOUR SMALL MANUFACTURERS—

These mills use only or mainly wastes for raw materials—wastepaper (including cement bags), rags, leather chips and cuttings, etc.—

Bernard Lawrence Pty. Ltd., (at Sydney, N.S.W.), and **Ernest Nelson Pty. Ltd.** (at Melbourne, Vic.), associated companies, each operating one mill, with cylinder/vat machines. Bernard Lawrence Pty. Ltd. is associated with a cardboard-box maker, and has a subsidiary company making nitrocellulose-lacquered plain and embossed suitcase boards, from board supplied by parent company. Ernest Nelson Pty. Ltd. has a subsidiary company with two establishments, one in Melbourne and one in Adelaide, operating as fibreboard processors (forming into various shapes and containers; laminating with leathercloth, felts, etc., for motor-vehicle body components), the fibreboard being obtained from the parent company;

BOARDS made:

AT SYDNEY FACTORY: Greyboard mainly (also called newsboard); to lesser extent, suitcase fibreboard and kraftboard.

AT MELBOURNE FACTORY: Bituminised board (including foundation trim-panel for motor-vehicle bodies); boot and shoe stiffener; heavy-weight carton board.

PULP, PAPER, PAPERBOARD

a second subsidiary company is concerned with specialised containers (such as for explosives) made from fibreboard obtained from the parent company. Ernest Nelson Pty. Ltd. is associated with a manufacturer of footwear, footwear stock and accessories, cardboard-boxes for footwear, and casein rod, sheet and discs.

Cardboards Pty. Ltd. (at Brisbane, Qld.) has one mill, with cylinder/vat machines. } **BOARDS made:**
 } **Greyboards:** boot and shoe stiffener boards.

Western Paper Mills (at Perth, W.A.) has one mill, with a 38-inch fourdrinier. Wastepaper is mainly used, strengthened with small percentage of imported chemical pulp. } **PAPER made:**
 } **Middles and ticket paper.** (Principal market is in the eastern States.)

THREE NEW MANUFACTURERS, BEING ESTABLISHED

Thomas Owen & Co. (Aust.) Ltd. is erecting a mill comprising two paper machines and one parchementising machine; the mill is adjacent to the A.P.P.M. Ltd. mill. Mill capacity is about 10,000 tons a year. (The company originated in the early post-war period as an equal joint venture of Thomas Owen & Co. Ltd., U.K., and A.P.P.M. Ltd., with public investment in preference capital; but in mid-1951 A.P.P.M. Ltd. purchased the U.K. company's half interest (with an exchange of shares in A.P.P.M. Ltd.), retaining the technical assistance of Owen, U.K., for production of the specialty papers to be made by Owen Australia.) Production of vegetable parchment began in April, 1952, using body paper from A.P.P.M. Ltd. The first paper machine is expected to be in use by early 1953 and will make writings and printings, made on behalf of A.P.P.M. Ltd. The second paper machine is expected to be in use by late 1953, and will make greaseproof, glassine and, possibly, body paper for parchementising. Pulp for greaseproof and glassine will be imported for some years, until A.P.P.M. Ltd. can extend its pulpmaking capacity, after which only proportioning long-fibred pulps will be imported.

PAPERS to be made:

Pure greaseproof
 Glassine
 Writings and printings (on behalf of Associated Pulp & Paper Mills Ltd.)

CONVERTED PAPERS to be made:

True vegetable parchment.

Tasmanian Board Mills Ltd. is erecting (at Launceston, Tas.) a board mill, to comprise a neutral sulphite semi-chemical woodpulp (eucalypt) plant, one board machine, and a pasting plant for solid-fibre container board. Wastepaper will also be used. Expected output is 8,000 tons of solid-fibre board a year, and production is expected to begin in mid-1953. The company was formed in 1946 and incorporates an established timber getting, milling, seasoning, moulding and merchandising company; those activities, together with manufacture of products mainly of wood (including motor-truck trays, office furniture) will be integrated with the paperboard mill. Pulpwood will be secured from the company's freehold forest areas, State concession areas, private lands and from sawmill and timber processing wastes. (Among the major shareholders is a company directly concerned with shipping and associated with a leading passenger and freight airline operating throughout Australia.)

BOARD to be made:

Cylinder-liner and filler-board, to be pasted at the mill to make solid-fibre container-board.

Fine Papers Pty. Ltd. has established a small mill at Albury, N.S.W., and is preparing to produce mould-made writings, tub-sized and air-dried. Commercial production is expected to begin in late 1953. Raw materials will be mainly clippings from textiles, clothing and manchester manufacture and good-quality rags. (Papers of this type have not been made in Australia.)

PAPERS to be made:

Mould-made writings, tub-sized, air-dried

In addition to the above companies, a company of long history in manufacture of high-grade writings and specialty papers in the United Kingdom, and engaged in merchandising of papers in Australia, is considering establishing a mill in Australia for production of writings and specialty papers, with an annual output of probably not less than 10,000 tons. The mill would make much of its own pulp, and also use textile wastes and imported pulps.

(Coating to make fine-surfaced printing paper and boards is carried out in Australia by two associated companies and one other company; gumming of printing paper by one company; paste-boards are made by two companies; and laminated suitcase-board by one company. See Chapter 5, "Paper Products, Printing, Signwriting, Photographic Materials".)

Part Two: Outline of Capacity of Manufacturing Activities

PULP, paper and paperboard manufacture in Australia is firmly established as a major basic activity. Extensions and modernisation now under way will make the greater part (but not all) of manufacturing capacity in the pulp, paper and paperboard mills of Australia equal to the production standards necessary to maintain the Australian industry in a strong position; but that capacity will not be equal to the probable demand for paper and paperboard.

Demand for paper and paperboard in Australia is increasing with the rapid rise in population and with increasing per-capita consumption as new and extended uses for paper products are developed, particularly in wrapping and packaging. Australian per-capita annual consumption of paper and paperboard at 1948-49 was estimated to be about 110 lb. (Waste recovery was about 20 lb. per capita a year.) Per-capita annual consumption in the United States of America was stated to be 358 lb.; and the average for Europe was 56 lb., highest being Sweden at 155 lb. and lowest being Greece at 5 lb.; per-capita consumption in the United Kingdom in 1948-49 was 102 lbs.

The Australian paper and board mills have been operating to full capacity (see Part One for tonnage capacity of each manufacturer), except that severe power rationing imposed in Tasmania at March, 1951, and continuing at present (middle 1952) has prevented the newsprint mill at Boyer from using more than 40 per cent. of its capacity, while the writings and printings mill at Burnie cannot use more than 80 per cent. of its machine capacity.

The full output of the newsprint mill is sold by contract until 1956. Associated Pulp and Paper Mills Ltd. (writings and printings) and Australian Paper Manufacturers Ltd. (mainly wrappings and boards) have been controlling their intake of orders as they have been unable to meet demand, and have returned to quota systems (such as operated throughout the 1939-45 War) for fair distribution; A.P.M. Ltd. has also reduced the number of its grades in order to produce principal grades in greater quantity.

The extreme pressure on capacity has been due first to the hitherto substantial price advantage of Australian-made papers and boards, second to the fact that paper merchants and indentors in Australia were unable (in 1950 and 1951) to secure from overseas mills their requirements and, further, were in difficulty in having all orders accepted by overseas mills. The heavy demand for Scandinavian papers had closed most order books there for appreciable periods. The United Kingdom is a major supplier of paper to Australia, but must seek much of its pulp from Scandinavia, from which other large users—in particular Germany, France, Belgium, Netherlands, and the U.S.A.—were buying large pulp tonnage. The U.S.A. and Canada were sizable suppliers of papers to Australia before the 1939-45 War, particularly of newsprint from Canada, and fine writings from both countries; but only a few types of papers and boards, in relatively small tonnage, have been permitted in the post-war period under import licensing controls because of need to limit the use of scarce U.S.A. and Canadian dollar funds to higher priority requirements.

Since the beginning of 1952 overseas prices for pulp, paper and paperboard have fallen so substantially that in some instances the price advantage hitherto enjoyed by Australian products has been lost. Excessive imports of certain types of board, and credit restrictions in Australia, have led to a slackening of the Australian demand for some lines. However, this is unlikely to affect to any major degree the long-term trend of increasing consumption.

PRODUCTION IN AUSTRALIA

The quantities of materials used and articles produced in pulp and papermaking in Australia

in 1949-50 and the three preceding years were as follows—

PRODUCTION:	1946-47	1947-48	1948-49	1949-50
	tons	tons	tons	tons
PULPMAKING:				
Pulpwood used	269,411	306,800	306,154	324,619
Woodpulp (chemical and mechanical) produced ...	88,690	86,139	82,964	87,837
PAPERMAKING:				
Materials used—				
Pulp of own pulping, and purchased or made in previous years	129,281	125,690	121,092	130,087
Straw	6,653	7,330	11,403	5,581
Old or waste paper	65,412	79,644	70,537	76,626
Total fibre materials used	201,346	212,664	203,032	212,294
Papers and boards produced—				
Newsprint	31,734	31,335	30,260	30,472
Blotting	854	902	221	321
Duplicating	1,454	2,349	1,774	2,450
Printings and Writings	24,208	22,823	23,816	26,565
Kraft Wrapping	30,428	32,547	36,821	27,413
Other Wrappings	5,244	4,472	9,722	3,393
Paper Felt	3,225	3,210	3,796	4,493
Other Papers	12,159	11,469	1,743	10,570
Boards	76,563	83,213	85,307	99,519
Total output of papers and boards	185,869	192,320	193,460	205,196

Output in 1950-51 was about 220,000 tons, the increased production over the previous year

being mainly of boards. In 1951-52, output was estimated at about 240,000 tons.

GAPS IN PRODUCTION

The rise in quantity and range of Australian-made paper and paperboard since 1938, when manufacture of chemical woodpulp began in Australia, has been rather spectacular; but the industry has not expanded to the much higher level of range and quantity that the Australian demand for paper and paperboard would warrant, mainly because of type and quantity limitations of indigenous resources of raw materials for pulp. (See "Limits of Pulp-making Opportunity", later this Part.) The gaps can be broadly described as follows—

OF PULP: The industry's consumption of chemical and mechanical woodpulp over the years 1946-47 to 1949-50 averaged 40,130 tons a year more than production of woodpulp in Australia. Imports of papermaking fibres in the same period averaged 44,130 tons a year, of which chemical and mechanical woodpulp averaged 40,550 tons. Other pulp (not woodpulp) and wastepaper (the equivalent of mechanical woodpulp) imported averaged 3,580 tons a year. Details of imports of all papermaking fibres for the five years 1946-47 to 1950-51 are as follows—

IMPORTS:	1946-47	1947-48	1948-49	1949-50	1950-51
	tons	tons	tons	tons	tons
Sulphite woodpulp (a)	19,743	20,985	31,405	14,800	13,615
Other chemical woodpulp	8,246	24,368	18,691	16,000	15,726
Total chemical woodpulp	27,989	45,353	50,096	30,800	29,341
Mechanical woodpulp	5,249	—	450	2,250	3,941
Waste paper (b)	1,850	5,290	2,534	650	2
Total mechanical woodpulp	7,099	5,290	2,984	2,900	3,943
Pulp, except wood pulp, for manufacturing paper	2,235	1,275	501	2	6,355
Total, all paper making fibres	37,323	51,918	53,581	33,702	39,639

(a) Sulphite pulp is not made in Australia. The white paper pulps made here are eucalypt soda pulp, bleached eucalypt sulphate pulp, mechanical eucalypt pulp, plantation-pine sulphate and mechanical pulps.

(b) Imported wastepaper consists mainly of newstrim, and the remainder of printed news, all of which was made with long-fibred pulp, mainly mechanical. It is used in Australia as the equivalent of mechanical pulp.

Over the five-year period 1946-47 to 1950-51 the proportions of papermaking fibre materials imported were 85 per cent chemical woodpulp, 10 per cent mechanical woodpulp (of which half was wastepaper—the equivalent of mechanical woodpulp) and 5 per cent of pulps not being woodpulp. The industry's present requirements of imported papermaking fibres—mainly for proportioning eucalypt pulps and not including stockpiling—appear to be not less than 50,000 tons a year. Imports for 1949-50 and 1950-51 were below the desirable minimum because of unavailability linked with very high prices. Pulp availability and prices for 1952 appear more favourable.

Australia has no major domestic source of long-fibred pulp at present, and import requirements are likely to increase due to the extensions now being made to Australian pulpmaking capacity. This paradoxically will increase the need for imported pulps of the required types for proportioning eucalypt pulps. By 1955 the industry's capacity to absorb imported pulp (for proportioning with Australian eucalypt pulps and for certain papers made mainly or wholly of imported pulps) may be up to and beyond 65,000 tons a year. In overall effect the pulpmaking extensions (with papermaking and boardmaking extensions) will substantially reduce imports, but only of certain grades of paper and paperboards.

Australia's annual requirements of overseas pulps is a very small percentage of the pulp at present exported by pulpmaking countries and could be quite easily satisfied. Although the

world demand for cellulose pulp is steadily rising—17 million tons in 1928 to 31 million tons in 1948 (15 million tons of 1948 total being used in United States of America)—there is a fairly general agreement in the industry that there is little likelihood of a continuing long-term shortage on a world scale. The short-term supply position is complicated and insofar as Australia is concerned could be markedly influenced by a slight change in U.S.A. demand. Further, since Australia depends almost entirely upon Scandinavia for papermaking pulps, a modest rise in consumption of paper and paperboard in those countries' export markets could also quickly affect Australian pulp imports. Import licensing of North American products (because of insufficient dollar funds) has almost excluded pulps from North America, the principal source for Australia throughout the 1939-45 War and early post-war years.

Wastepaper collection was intensively conducted in Australia throughout the 1939-45 War, and has been continued. The collecting system is well organised, particularly in the

capital cities and large country centres. Fluctuations have occurred, due to variations in the available supply (the shortage of newsprint having considerably lessened availability), and in the needs of mills using wastepaper. Wastepaper usage at mills in 1949-50 represented 21 lb. per capita, compared with nearly three times that recovery in the United Kingdom. However, in Australia, other than in the metropolitan areas, the waste is not available in such concentration of supply as occurs in highly-populated smaller countries and, further, Australia exports a sizable portion of its paperboard production, container-board in particular, as foodstuffs packaging. The "wastes" imported into Australia are essentially a substitute for mechanical pulp (see footnote to table of imports of papermaking fibres above).

OF PAPER AND PAPERBOARD: Statistics for imports of paper and paperboard have been available in greater detail than heretofore since 1948-49, and permit an examination of the proportion of imports of various types of papers and boards that are also made in Australia.

It became difficult in 1949 to place orders for early delivery of many types of paper and paperboard and consequently the total tonnage delivered to Australia in 1949-50 (except for carton and box boards) was considerably less than for the previous year. Deliveries in 1950-51, apart from a few lines, were generally substantially in excess of those of 1949-50. Imports of "off-machine" papers and paperboards (that is, not pasted, coated, gum-

PULP, PAPER, PAPERBOARD

med, impregnated or otherwise processed or converted) for the three years 1948-49 to 1950-51 were—

IMPORTS:	1948-49	1949-50	1950-51
	tons	tons	tons
Types made in Australia—			
Boards	21,197	14,938	27,357
Wrapping papers	12,912	6,227	19,689
Printing papers (a)	13,198	5,421	10,440
Writing papers	2,037	704	1,480
Miscellaneous papers	1,205	1,133	1,835
Totals, types made in Australia	50,549	28,423	60,801
Types not made in Australia—			
Boards	812	822	1,732
Wrapping papers	11,273	8,160	15,577
Printing papers	14,186	11,628	29,469
Writing papers	8,128	4,562	12,450
Miscellaneous	1,713	1,854	1,103
Totals, types not made in Australia	36,112	27,026	60,331
Totals, "off-machine" papers and boards	86,661	55,449	121,132

(a) Includes supercalendered printings.

Newsprint and mechanical (or magazine) printings are not considered in the examination set out above. They probably will be imported in large tonnages for years to come, because on present knowledge and circumstances, there is a pronounced lack of indigenous pulp materials economically attractive for printings normally made from groundwood pulp. (However, bagasse is a material that could become available in large quantity in Australia. It appears likely that bagasse will be used for newsprint manufacture in the U.S.A.—see "Limits of Pulpmaking Opportunity"—later this Part.) Imports of newsprint

and magazine printings over the three years 1948-49, 1949-50, 1950-51 averaged yearly 116,014 tons of reel newsprint, 5,134 tons of sheet newsprint, and 16,546 tons of magazine and other printings containing more than 25 per cent. mechanical pulp.

All except one of the established large mills are being expanded as quickly as physical circumstances permit to catch up with the market for their products (see "Current Expansion of Capacity", later this Part).

Papers not made in Australia and imported steadily in tonnage and value great enough to have encouraged action towards manufacture in Australia are greaseproof food-wrappings; toilet, tissue and similar tissues; and high-grade writings, including rag-content. Comment on action being taken to make those papers, and statistics of imports, are stated below, in the section headed "Current Expansion of Capacity".

Imports of IMITATION ART, 930 tons in 1948-49, 748 tons in 1949-50, and 1,833 tons in 1950-51, have enticed consideration, as manufacture in Australia is practicable, but no established company has made it as a commercial grade; it is somewhat of a specialty paper, and the preferred practice is to keep capacity engaged on papers in demand and more readily made. MACHINE-PROCESS COATED PRINTING PAPER could also be made in Australia, and probably the demand would rise with its availability from an Australian mill; imports were small in 1948-49 and 1949-50—249 tons, 348 tons, but rose to 1,537 tons in 1950-51. (Machine-process coated board is made in limited range in Australia.)

CURRENT AND ANNOUNCED EXPANSION OF CAPACITY

Action towards increased capacity for papers and boards of types already being made in Australia, and capacity for papers not yet made in Australia, is described below. The enterprise of established companies and new entrants is well based and the industry is being extended and strengthened to a notable degree.

For Papers and Boards Being Made in Australia

Where the established companies in Australia could in post-war expansion readily base new capacity on indigenous sources of raw materials the step has been taken or is under way. Only one established company, which operates one board mill, has not entered into considerable post-war expansion. Substantial extensions to pulpmaking capacity at the two chemical-pulp mills are now being made or planned to supply additional paper machines being installed at each of these two mills. However, additional machine capacity now being installed and to be installed over the next few years at mills not making pulp, and modernisation of older machines and plant, will in total keep machine capacity in Australia well ahead of contemporary pulpmaking capacity.

It is not anticipated that any of the extensions will provide excess capacity. Rather, it is expected that before present extensions are completed it will be necessary to begin either serious planning or actual work for further extensions.

Part One, which describes the structure of the pulp, paper and paperboard industry in Australia, provides an outline of established capacity and extensions under way, for each of the established manufacturers (and by new

manufacturers). These over all are planned to increase 1945 capacity of 195,000 tons by nearly double.

All of the extensions are significant, but it is thought worthwhile to comment further on three projects—the expansion of boards and wrappings capacity, the establishment of a board mill in Queensland, and expansion of the writings and printings mill in Tasmania.

Expansion by Australian Paper Manufacturers Ltd. at its various mills will add notably to production of boards and wrappings. Consumption in the Australian market is well ahead of Australian production, and in particular the potential for increased per-capita use of container boards, carton and box boards and miscellaneous cardboards is quite striking.

The first substantial move by any company to manufacture in Queensland has been made by Australian Paper Manufacturers Ltd. It is erecting a board mill near Brisbane, located so that local wastepaper can be used, and so that the fast-growing local market for paperboards for cardboard boxes and cartons can be supplied "on the spot". It is possible that a pulping unit to utilise hardwoods of Queensland origin will be added.

Associated Pulp and Paper Mills Ltd. had decided to establish a two-machine writings and printings mill, and a chemical-pulp mill, on the mainland. Early in 1952, the company announced that the two paper machines would be installed at Burnie, Tasmania, instead. The mainland pulpmill project has been deferred. Expansion by the company in Tasmania in the post-war period has been great and is continuing, but is approaching the limits of pulpwood and other resources. The current expansion

will add a substantial contribution to production of writings and printings of the big-demand type.

Australian capacity for manufacture of newsprint reached at mid-1951, after a post-war more-than-doubling of capacity, what appears to be a long-term maximum of about 80,000 tons a year, imposed by pulpwood resources available to Australian Newsprint Mills Ltd. (Production from mid-1951 to date—middle 1952—has been at about 40 per cent. of capacity, because of severe power rationing.) The mill, at maximum use of capacity, would produce a little less than one-half of the likely and very restricted usage of newsprint in Australia in 1951—and only about one-third of usage if all the tonnage that could be used could be secured. No other project for manufacture of newsprint in Australia has been announced.

For Papers Not Made in Australia

Part One, which describes the structure of the pulp, paper and paperboard industry in Australia, provides an outline of projects by new manufacturers (and by established manufacturers). Additional comment is set out below, together with imports statistics of the types of papers to be made by the new manufacturers.

A mill to parchmentise body paper for TRUE VEGETABLE PARCHMENT and to make PURE GREASEPROOF and GLASSINE has been erected by Thomas Owen & Co. (Aust.) Ltd., a subsidiary company of Associated Pulp and Paper Mills Ltd. Installation of plant is still under way. The company expects to meet almost the whole of the demand for those wrappings when it is in full operation about 1954. Parchmentising of body paper from the adjoining A.P.P.M. Ltd. mill, the first phase of

production at the Owen mill, began in 1952. The 1948-49, 1949-50 and 1950-51 imports were as follows: Pure greaseproof, 64,600 cwt., 33,500 cwt., 84,500 cwt.; glassine, 6,720 cwt., 1,750 cwt., 8,040 cwt.; true vegetable parchment, 36,000 cwt., 17,100 cwt., 34,700 cwt.

Australian Paper Manufacturers Ltd. has equipment on order to convert one of its paper machines to make light-weight CREPE TISSUE for toilet and similar tissues. The 1948-49, 1949-50 and 1950-51 imports of "toilet tissue and tissue cap" were 6,500 cwt., 12,600 cwt. and 29,800 cwt. Other tissue imports, both flat and crepe, were: Fruit wrapping (including printed), 41,703 cwt., 14,120 cwt. and 33,364 cwt.; tissues for waxing, 2,062 cwt., 2,412 cwt. and 1,847 cwt.; tissue and tissue cap otherwise (not including cigarette paper, and tissue for napkins, handkerchiefs and serviettes), 58,800 cwt., 66,800 cwt. and 94,850 cwt.

HIGH-GRADE WRITINGS, including rag-content and animal tub-sized, air dried, and specialty papers, are papers which a leading U.K. maker of such papers (also itself engaged in paper merchandising in Australia) is considering making in Australia. The 1948-49, 1949-50 and 1950-51 imports of writings were as follows: Hand-made and mould-made, all kinds, 381 cwt., 2,445 cwt. and 454 cwt.; animal tub-sized otherwise, 20,000 cwt., 15,500 cwt. and 24,000 cwt.; cream and tinted laid and wove, 28,150 cwt., 9,171 cwt. and 17,580 cwt.; airmail writing, etc., 5,330 cwt., 4,050 cwt. and 4,152 cwt.; banks, 92,400 cwt., 33,300 cwt. and 126,710 cwt.; bond, 27,700 cwt., 24,300 cwt. and 44,700 cwt.; embossed writings, 8,870 cwt., 6,120 cwt. and 6,290 cwt.; sensitised cheque paper, 1,310 cwt., 920 cwt. and 822 cwt.; other writings, 29,330 cwt., 16,280 cwt. and 60,905 cwt.

FURTHER OPPORTUNITY

The established companies have been and remain alert to long-term opportunities offering through the expected and probable lift of the Australian population, 8.4 million at mid-1951, to 10.5 million by 1960. The search for good mill sites embracing adequate pulping material, water, fuel, power, labour, economic transport, etc., has been long and thorough, particularly in eastern Australia. One new area is to be developed by a leading established company (see previous section, "Current Expansion of Capacity").

Nevertheless, opportunities appear to exist for others. For example, the contemplated establishment by a leading U.K. papermaker of a mill for high-grade writings and specialty papers will be a natural complement to the large-tonnage "bread-and-butter" printings and writings manufacture already established; and also a natural step to be taken by a leading overseas fine-paper maker engaged in widespread merchandising of its imported papers throughout Australia and New Zealand. The small container board mill being erected at Launceston, Tas., will be a natural complement to medium-scale logging and sawmilling activities already carried on by the same company.

Further opportunity may be present. The company making wrappings, container liner and filler, carton and box boards and miscellaneous cardboards, itself estimated at mid-

1950 that at conclusion of its present and immediate proposed extensions, at the end of 1955, it will be producing 50,000 tons less than demand for the products of which it is the principal manufacturer in Australia; and also pointed out that Australian per-capita consumption of board was much below what it could be—in 1948-49 the U.S.A. annually consumed 69 lb. per capita of corrugated and solid-fibre container board, 38 lb. of carton and box boards, 40 lb. of miscellaneous cardboards, whereas Australian consumption was 10 lb., 16 lb., and 5 lb. respectively.

It is notable, however, that what appears to be an opportunity at or near Sydney or Melbourne for a small, modern board mill, based on local wastes and straw, and a small measure of imported pulp, has not attracted newcomers, nor enticed the two associated companies operating two sheet-board mills (newsboard, footwear stiffener, trim-panel, etc.) to extend to a reel-board mill. Nor has the exceptionally promising future for container-board use in Australia attracted more than one new manufacturer.

The high capital cost per output-ton required to establish a modern mill, the great output needed for economic operation and the relatively slow turnover of capital invested, are factors which combine, apparently, in limiting new entrants to papermaking in Australia at the present period.

LIMITS OF PULPMaking OPPORTUNITY

Mills requiring mainly woodpulp (that is, new fibre) and entirely or mostly dependent upon imported pulp could be more readily established, relatively, in Australia than mills making their own pulp, but the hazard of irregular pulp supply, the need for large stockpiling of pulps, and the high cost of imported pulps, are now difficulties to be carefully considered in Australia. Mills without capacity for pulpmaking from wood or alternative fibrous materials other than waste, are numerous in the United Kingdom, the Continent and in the United States of America.

Eucalypts

Advancement in the type and quantity of papers and paperboards made in Australia has been achieved in the face of considerable natural disadvantages relative to establishment and growth of the industry in Europe and North America. The Australian industry began to develop substantially when intensive research enabled *Eucalyptus regnans* and *E. delegatensis* (or *gigantea*), the "Mountain Ash" and "Alpine Ash" eucalypts of south-eastern Australia, to be used commercially for soda and sulphate chemical pulps, and for groundwood.

With continued research, governmental and private, and quickly widening experience arising out of the pulping of eucalypt species in steadily increasing quantity, a few eucalypt species other than the Mountain and Alpine Ash are being used to a greatly increased degree, particularly for chemical pulps. Frequently these species are in mixed stands with the "Ash" eucalypt, but purer stands are now being utilised. It is thought that with further experience and research—and spurred by the need—more of the commoner species of eucalypt will be found suited for paper pulps, particularly chemical and semi-chemical pulps. For newsprint groundwood, at present state of knowledge, the 80 per cent. eucalypt portion of the furnish requires the "Ash" type as the major constituent, and trees that are mature, but not over-mature.

The eucalypts, being hardwoods, make short-fibred pulps. For many furnish requirements in Australian mill practices, such pulps require "proportioning" for tear and fold strengthening with long-fibred pulps, mainly imported chemical pulps, in a range from 5 per cent. to near 50 per cent. of quantity. Eucalypt pulps have certain advantages, however, mainly a high yield of pulp from the wood and good surface finish of papers made from the pulp. At times, furnishes almost or entirely of imported long-fibred pulp are used, but as general and preferred practice the highest possible proportion—100 per cent. with some papers and boards—of eucalypt pulp is used consonant with required characteristics and quality of product.

The resources of eucalypt pulpwoods are limited to relatively small areas of Australia's very limited forests, which cover about 1 per cent of the total area of Australia. Resources of *Eucalyptus regnans/delegatensis*, which are also important sawn-timber species, have reached maximum permanent pulpwood cutting. There are few areas in coastal eastern Australia where it is thought pulpmills could be readily established. In the south-west of Western Australia there are sizable resources of at least one eucalypt species that may prove suitable for paper pulp; however, the Western Australian market for papers or

boards would not support a mill of substantial size, which would have to export, or ship by long sea-haul to the eastern States of Australia, thus incurring disadvantageous freight rates.

A factor that would create further and significant demand for eucalypt pulpwood is the manufacture of DISSOLVING PULP, not yet commercially made in Australia, but on which extensive and successful research has been done. Alpha-cellulose pulp for cordite manufacture was made in Australia from plantation-pine (*Pinus radiata*) in considerable quantity throughout the 1939-45 War. The demand for dissolving pulps is rapidly increasing throughout the world with the widespread use of rayon and cellulose-based plastics materials, and now requires about 5 per cent of the world's output of pulp. Australian Paper Manufacturers Ltd. announced (at mid-1951) that it has produced acetate and viscose dissolving pulps from eucalypt pulpwood. Further work has to be done to satisfy the company that rayon and plastics acetate pulps produced satisfactorily by it under laboratory conditions can be produced commercially, but with viscose pulp the company hopes to be ready to supply commercially when the manufacture of viscose filament for tyre cord yarns begins in Australia in the near future.

Another product of viscose dissolving pulp is regenerated-cellulose film (better known by a proprietary trade name "Cellophane"), the demand for which in Australia, for wrapping and for the manufacture of pressure-sensitive tape, has grown rapidly and cannot be met with present supplies. Imports of plain, printed or embossed transparent cellulose (those categories are not separately recorded) in 1948-49 were 1,053 tons, in 1949-50, 856 tons, and in 1950-51, 1,586 tons. Courtaulds (Australia) Ltd., which is now establishing a viscose-rayon spinning mill in Australia, has announced that it intends, as opportunity offers, also to make transparent cellulose film.

Plantation-Pine

Extensive cultivation of plantation-pine (usually the Monterey Pine, *Pinus radiata*) will probably, in the long term, considerably mitigate the natural lack in Australia of long-fibred pulpwood in commercial quantity. However, the paucity of indigenous softwood timber, relative to demand, ensures priority for sawn timber that will continue whatever supply of plantation-pine becomes available.

In 1950 Australian Paper Manufacturers Ltd. purchased a well-established plantation in New South Wales of 940 acres of Monterey Pine, from which it is now cutting mechanical pulpwood for its Sydney mill, and is extending the planted area.

In 1951 the company began planting Monterey Pine on an enormous scale in the Gippsland, Victoria, area, where the company's eucalypt sulphate pulpmill is situated. Using a fleet of mechanical tree-planting machines capable of planting 50,000 trees a day, over two million trees have already been planted on nearly 3,000 acres; 4,000 acres are to be planted during 1952, and 3,000 acres each year until 1957. The intention is to supplement overseas supplies of long-fibred pulp with similar pulp of its own manufacture. (During the 1939-45 War the company at an annexe to the Gippsland mill made a considerable tonnage of alpha-cellulose sulphate pulp from

Monterey Pine pulpwood, for use in cordite manufacture.) Fire-killed pine at large plantations in South Australia was salvaged in 1951 and converted to sulphate pulp.

About 5,000 tons a year of plantation-pine groundwood pulp has been made for some years by the board mill of Cellulose Australia Ltd., adjacent to radiata plantations in south-east South Australia.

New Zealand has plantations of pine, mainly radiata, six times as extensive as in Australia and at present far greater than can be consumed in New Zealand. A plan has been agreed to in which a company, Tasman Pulp and Paper Co. Ltd., formed by the New Zealand Government, and enterprises in New Zealand, Australia and U.S.A., will produce sawn timber, newsprint and pulp from plantation-pine of several species covering an area of about 200,000 acres. The Government will spend £14 million on roads, railways and wharf facilities (road work has already begun). The operating company will erect at Tauranga integrated mills costing £15 million to produce yearly 40 million board feet of timber, 60,000 tons of newsprint and 35,000 tons of sulphate pulp. It is planned to have the mills operating in about three years. Australia has continuous need for softwood timber and for pulp and newsprint, and New Zealand has a persistently large unfavourable trade balance with Australia, from which it purchases a wide range of manufactured goods; the scheme is therefore of considerable advantage and significance to Australia. In addition, N.Z. Forests Products Ltd. is now erecting a sulphate mill at Kinleith, N.Z., and has contracted to supply a minimum of 12,500 tons of unbleached pulp a year to the newsprint mill at Boyer, Tasmania, for a period of twenty years; delivery is expected to begin in the latter half of 1953.

Straws and Grasses

The limitations of quantity and location of indigenous pulpwoods long ago turned attention to consideration of greater use of cereal straw (mainly wheat) and bagasse. A number of difficulties, both economic and technical, have kept the use of bagasse (see following "Straw"), and general use of wheat straw, in the fugitive class of possible additional Australian sources of pulp fibre.

Although Australia is a considerable producer of wheat (about 12 million acres sown in 1950-51) the proportionate amount of WHEAT STRAW available is much less than in other countries. Wheat is mainly harvested by heading or stripping, and the stalks later burned or ploughed in. Reaper-and-binder/thresher harvesting is limited in extent, the yield of straw to the acre is lower on average than in Europe, and there are from time to time severe falls in supply when bad seasons considerably reduce the harvest. Nevertheless, the total availability of straw in some areas could be considerable.

The quantity of straw used by Australian paper and board mills over the five years, 1944-45 to 1949-50, averaged 7,970 tons a year, comprising wheat and oat straw mainly, barley and rice straw occasionally, all used with waste-paper in furnishes for several types of boards. When waste paper supply is inadequate, more straw is used in chipboard furnishes. Pure strawboard is not made in Australia, the "strawboard" of Australian manufacture being a semi-bending quality containing up to 25 per cent. waste paper.

Wheat and similar straw is being used in several countries to an increasingly consider-

able extent for various types of papers, including high-grades; but the plant and treatment required for success is specialised. Mill sites that are favourable for supply of straw, and with water and power, are said to exist, but tend to be unfavourable for freight reasons, being distant from main paper and paperboard consumption centres. There is, however, a belief that the use of straw (and bagasse) for papermaking in Australia will not be widely adopted while there is an opportunity of making effective use of indigenous forests, natural and planted, native and introduced species, because of the superiority of wood over grasses as an economic source of paper cellulose.

The quantity of BAGASSE created in Australia is increasing with expansion of sugar-cane acreage and crushing (see "Sugar Milling and Refining", Chapter 13). The annual quantity of cane being crushed now exceeds 6.5 million tons, providing about 1.5 million tons of undried bagasse, which is principally used in Australia (as elsewhere in the world) as fuel for sugar-mill furnaces; a minor use in Australia is in the manufacture of a building and insulating wallboard. As fuel, three tons of undried bagasse are equal to one ton of coal, but the mill furnaces are specially designed to use bagasse and would require conversion to use coal or oil. To make bagasse available in the large quantities required for a sizable paper mill the sugar millers would require a price that compensated for additional fuel cost (and would look for a guarantee that the alternative fuel would be as regularly available as the bagasse). If such a price were economic to the papermakers, a maximum of over a million tons (presumably undried weight) of bagasse may be available each year. That quantity would be spread over the whole of the sugar-growing area, a coastal and narrow strip about 1,500 miles in length; however, considerable tonnages of sugar-cane are milled at several points.

Bagasse is usually not regarded favourably as a papermaking material, partly for technical reasons, but mainly because more economic materials are usually available where bagasse is disregarded. There is a mill in the Philippines specially designed to use bagasse; it has now operated for twelve years and is reported to be successfully engaged in making fine papers (banks and bonds) with as high as 95 per cent. bagasse fibre content (the remainder being imported long-fibred woodpulp). Encouraged by that success, other paper mills to use bagasse are being erected in large sugar-cane growing countries, where suitable pulpwoods are not freely available. The Philippines mill is utilising bagasse that has been compressed when wet (that is, fresh) by a high-capacity baling machine into solid bales of a convenient size (12 in. x 12 in. x 24 in), weighing about 90 lbs. initially. The compressed bales are stored in stacks for a period of three to six months, according to the climate. During that time the water in the bagasse gradually dries out until only 12 to 15 per cent. of moisture is left in the bales, the weight of which is correspondingly reduced. The dried bagasse bales are disintegrated by specially designed plant before being passed to the pulpmill. "The World's Paper Trade Review" (a leading journal of the U.K. papermaking industry) concludes its report (5/10/50) on the Philippines mill with the following comment—

"Since fine paper pulp is successfully being made from bagasse, it follows that lower grades can also be readily produced, and the manufacture of insulating

board and corrugating board from this material is well known. An interesting development has been the discovery that wrapping papers, which have strength properties of the same order as pure kraft paper, can be made with mixture of bagasse semi-chemical pulp and kraft pulp containing 50 per cent. or even 75 per cent. of bagasse. The cost of the bagasse semi-chemical pulp is only a fraction of that of imported kraft pulp. The capital outlay required for the manufacture of semi-chemical pulp is naturally considerably less than that for the bleached pulp used in writing and printing papers, and it has been found that the continuous-digestion unit used in the first part of the complete Celdecor-Pomilio process provides an economical and simple method of producing pulp of this grade in large volume. So far as newsprint is concerned, bagasse chemical pulp can replace chemical wood-pulp in whatever proportions that may be used in manufacturing newsprint. No method has been developed for making mechanical pulp from bagasse; and since it is extremely difficult in normal times for chemical pulp to compare in cost with mechanical pulp, it is unlikely that bagasse will prove economical for newsprint production except under abnormal economic conditions. One thing is clear; paper from bagasse is well beyond the experimental stage, and an extended use of this material may be anticipated in many parts of the world which at present are not now associated with papermaking."

The same journal in its issue of 20/3/52 concludes its report of India's new bleached bagasse pulp plant—the first in the British Commonwealth—with the comment:

"The start-up of this mill demonstrates new possibilities to a world increasingly conscious of wood-pulp shortage and high prices. . . . The value of bagasse as a papermaking fibre much exceeds its value as a heating medium and the cost of replacing it with alternative fuels. It is one of the cheapest papermaking raw materials in the world, and in India, for example, its successful introduction may prove to be as far-reaching as was the first bamboo pulpmill. . . . Plants for pulping bagasse are at present under construction in South Africa, Brazil and Mexico."

There is a likelihood, however, that bagasse newsprint may be made commercially in the U.S.A. or at Cuba in the near future. The

United States Forests Products Laboratory has announced that "bagasse newsprint has proved considerably stronger and much whiter than ordinary newsprint, and has physical properties closely approaching those of standard newsprint made from wood". The inventor of the process states that he intends to build a bagasse newsprint mill at Florida, U.S.A., to produce 45,000 tons a year, at a cost (he states) no more than newsprint made from wood.

LINSEED STRAW has been considered for papermaking now that the acreage of linseed (48,000 acres planted in 1950-51) is developing into a significant Australian crop. Linseed straw could provide a useful quantity of long-fibred pulp, but the cordage industry is a likely competitor for linseed-straw fibre, and better placed to secure it because the end products will permit a higher buying price for the straw. The cordage industry similarly absorbs the small flax-tow supply in Australia.

GRASSES of the genus *Imperata*, usually known as "Kunai", which are particularly abundant in Papua and New Guinea, have been considered after trial to be approaching esparto in papermaking qualities. However, in addition to being a long sea haul from mills and main paper consumption areas in Australia, other grasses are also present to considerable and variable extent in Kunai grasslands, creating a quality control problem in pulping. A health hazard is present, in that scrub typhus is commonly associated with such grasslands in Papua and New Guinea. It would seem that under present circumstances of pulp supply and price that the use of native tropical grasses is unlikely.

The *Imperata* grasses also occur throughout Australia, and are prevalent in tropical Australia, but not to the extent of the height, density or area of strikes in the high rainfall areas of Papua and New Guinea.

Part Three : Basic Statistics

COMPARATIVE STATISTICS, 1938-39/1949-50

NUMBER OF ESTABLISHMENTS AT 1938-39 AND 1949-50

NUMBER OF EMPLOYEES AT 1938-39, 1949-50, JUNE 1950, SEPTEMBER 1951

Activity (Statistical Sub-class used by Commonwealth Statistician, 1949-50)	Establishments		Employees			
	1938-39	1949-50	1938-39	1949-50	June 1950 (a)	Sept. 1951 (a)
Paper-making (b)	no. 7	no. (c) 14	no. 1,961	no. (c) 6,160	no. 6,125	no. 7,425
Totals (d)	7	14	1,961	6,160	6,125	7,425

STATISTICAL SUMMARY, 1949-50

EMPLOYMENT, MALE AND FEMALE

SALARIES AND WAGES PAID, IN TOTAL AND PER PERSON ENGAGED

VALUE OF PRODUCTION

VALUE OF MATERIALS, POWER, FUEL, REPAIRS, etc.

VALUE OF OUTPUT

See Explanations,
Appendix IV

Activity (Statistical Sub-class used by Commonwealth Statistician, 1949-50)	Employment			Salaries and Wages Paid		Value of Pro- duction	Value of Materials, Fuel, etc. Used	Value of Output
	Males	Females	Persons	Total	Per Person Engaged			
Paper-making (b) (c)	no. 5,541	no. 619	no. 6,160	£'000 3,184	£ 517	£'000 6,581	£'000 7,152	£'000 13,733
Totals (d)	5,541	619	6,160	3,184	517	6,581	7,152	13,733

Explanatory Footnotes to Both Tables

- (a) These employment figures are taken from monthly payroll-tax returns and differ slightly from the other employment figures, which are supplied on annual factory returns.
- (b) Also includes preparation of materials (that is, manufacture of woodpulp; of cooking and bleaching chemicals when made at the pulpmill; breaking up and cooking of waste papers and paperboards and of straw) and manufacture of paperboards. Does not include converting of paper and paperboard, such as coating (art paper), pasting, gumming, laminating, corrugating, etc., where carried on as the main activity of the factory concerned.
- (c) Includes two small establishments engaged in paper converting, and inadvertently classified as papermaking mills.
- (d) Consideration and comparison of totals must take into account the effects stated in footnotes explaining the composition of the sub-class and figure units.

Chapter 5:

PAPER PRODUCTS

PRINTING

SIGNWRITING

PHOTOGRAPHIC MATERIALS

Part One: Structure of Established Manufacturing Activities

PROCESSING of paper, the making of stationery, containers and other paper products, the activities of printing and of signwriting and making and processing of photographic films and papers, are established in Australia as listed below. The listing is intended to be reasonably indicative, but not necessarily fully inclusive.

PAPER AND PAPERBOARD CONVERTING

There are about 330 establishments in Australia wholly or mainly engaged in one or more of the activities of paper and paperboard converting—the making of processed papers and paperboard in preparation for printing and/or fabricating, the manufacture of stationery, paperboard containers, paper bags, and other paper products. (Regenerated-cellulose film, usually known by a tradename "Cellophane", is here included with paper.)

Overlapping of activities within the converting industry is not considerable, but considerable association exists between the converting industry and the printing industry proper. Most of the large establishments wholly or mainly concerned with converting carry on printing as an incidental and usually the lesser part of manufacture of stationery, containers, bags; and some of those establishments are also jobbing printers as a lesser part of the general activity. Similarly, many establishments mainly concerned with printing (and therefore statistically classified as printers) are also manufacturers of paper products as a lesser part of the general activity. Several of the converters, including some of the largest, are divisions of companies operating allied divisions, including general printing.

The processing of paper and/or paperboard for printing and/or fabricating—for example, container-board manufacture, laminating (pasteboards), coating, waxing, slitting/rewinding, sheeting—is not separated statistically, because the activities are dispersed among stationery manufacturers, container manufacturers, and a few specialist processors. Therefore, several of the processing activities shown below as part of stationery manufacture, container manufacture, and a miscellaneous group of activities, are not wholly included within any one of those three statistical groups.

The employment-size groups of establishments wholly or mainly engaged in manufacture of paper products in 1948-49, and total employment of those establishments, were as follows—

ESTABLISHMENT SIZE:	Up to 10 Persons		11-20 Persons		21-50 Persons		51-100 Persons		Over 100 Persons		Total
	Est.	Pers.	Est.	Pers.	Est.	Pers.	Est.	Pers.	Est.	Pers.	Est. Pers.
Manufactured Stationery ..	49	270	20	292	31	997	18	1,300	7	1,301	125 4,160
Paperboard Boxes, Cartons and Containers ...	22	152	26	390	24	765	21	1,463	8	1,531	101 4,301
Paper Bags ...	18	94	11	176	9	292	7	436	1	105	46 1,103
Other (a) ...	36	192	9	135	5	145	2	123	1	160	53 755
Totals ...	125	708	66	993	69	2,199	48	3,322	17	3,097	325 10,319

(a) This group includes laminating, varnishing, gumming, coating (for art paper) and sensitising of paper, cutting of paper (as trade service), paper shredding, wastepaper sorting, manufacture of paper patterns, gold blocking, and rubber-stamp manufacture, where any one of such activities is carried on as the sole or major activity.

The total numbers of establishments and the persons employed for each activity in 1949-50 were as follows: Manufactured Stationery, 130 establishments, 4,371 persons; Paperboard Boxes, Cartons and Containers, 108 establishments, 4,455 persons; Paper Bags, 46 establishments, 1,029 persons; and "Other", 57 establishments, 796 persons. The totals for 1949-50 were 341 establishments, 10,651 persons.

MANUFACTURED STATIONERY: In 1949-50 there were 130 establishments employing 4,376 persons, and in 1948-49 125 establishments employing 4,160 persons, wholly or mainly engaged in manufacture of one or more paper products within the general but loose description of "stationery", including—

Consumer Stationery—

Table stationery (writing pads and envelopes), including boxed sets
Pocket diaries

Exercise books, note books, drawing books, memo and scribbling pads, etc.

Albums
Greeting cards
Games

Commercial Stationery—

Envelopes of full size range
Diaries, desk, trade, pocket
Account books, ledgers, wage and time books, etc.
Memo pads, scribbling pads
Carbon paper (and ribbon)

Typewriter stencils
Ledger sheets
Docket books
Cheque books
Invoices, statements, in continuous form

Price tickets and tags
Shipping tags, printed and not printed
Card-index systems
Loose-leaf binders
Manilla folders

Other Products (the manufacture of some of which, when carried out by a manufacturing stationer, is usually described by the manufacturer as "paper-converting" to distinguish that part of overall activities from the manufacture of orthodox stationery lines)—

Toilet paper, in rolls and interleaved sheets	Cigarette tubes	Drinking straws
Towelling, in rolls and interleaved sheets	Patty pans, chocolate cups	Party and carnival novelties
Cigarette papers, packeted	Serviettes, d'oyleys	Creped decorative paper
	Waxed papers and boards, plain and printed	Gummed tape
		Pressure-sensitive tape

The 25 largest establishments employed nearly two-thirds of employment in the 125 establishments. In addition, several large printing establishments statistically classified as such are large to medium-scale producers of stationery and other paper products, integrated with the printing activity, and operate retail outlets for their own and other Australian-made stationery, and for imported stationery.

Three of the large producers of stationery, and two smaller producers, all engaged wholly or mainly in the activity, are paper and stationery merchants, each with wholesale distributing warehouses at each capital city on the mainland. The manufacturing activity is carried on either directly or through a subsidiary company, and in all 10 establishments are operated. Two of the largest, and one of the smaller, of the five producers are branches of United Kingdom papermaking companies. Generally, the five companies are mainly producers of orthodox stationery products—envelopes, writing pads, exercise and drawing books, account books, diaries, card indexes, loose-leaf binders, etc.; one of the companies is a considerable producer of plain and printed waxed papers, and another makes a specialty of account books and a wide range of pocket and desk diaries, and boxed stationery.

Some of the products listed above are each produced in Australia by one or a few manufacturers, several large in size, the remainder medium to small in size. Examples are as follows—

Straight Converting—

Carbon paper and ribbon	Gummed tape (also called stay tape)	Toilet paper of perforated sheets interleaved
Cigarette papers, packeted, and cigarette tubes	Pressure-sensitive tape (of transparent cellulose)	Towelling, in rolls and in perforated sheets interleaved
Creped decorative paper	Straws, drinking	Typewriter stencils
Party novelties		Waxed papers, plain

Products requiring Printing and/or Ruling—

Cheque books	Exercise books, low-cost	Price tickets
Continuous stationery (statements, invoices, etc.)	Games and puzzles	Transfers (decalcomania)
Docket books	Greeting cards	Writing pads, low-cost
	Playing cards	

PAPERBOARD BOXES, CARTONS AND OTHER CONTAINERS: In 1949-50 there were 108 establishments wholly or mainly engaged in the manufacture of paperboard containers, employing 4,455 persons; in 1948-49 101 establishments employed 4,300 persons. About 30 of the largest establishments employed a little more than two-thirds of employment in the 101 establishments. In addition, a sizable number of establishments statistically classified as printers, produce containers, cartons in particular, as an integrated activity, collectively substantial in output, but not comparable to that of all establishments primarily concerned with carton manufacture. No official statistics exist as to the number of establishments engaged in each of the principal types of containers.

Fibreboard Containers: Eleven companies, operating 16 establishments, make all the corrugated container-board made in Australia, and themselves make up practically all the board into containers; most also make solid-fibre container-board and containers, and a few companies buying in solid-fibre board from a paperboard mill in Australia and imported board make up solid-fibre containers. Drums of solid-fibre are made by one manufacturer only.

Cardboard Boxes: At least 70 manufacturers, most of the larger of which also make cartons.

Cartons: At least 40 manufacturers, including some large specialists.

Other Containers: Waxed drinking cups, ice-cream tubs and tubs for other uses, paperboard cans (spiral tube and laminated tube), are each made by only a few large manufacturers. Moulded-pulp containers (egg "flats" and "trays", retail egg-packs, bottle wraps) are made by one company only, also making cartons.

PAPER BAGS: In 1949-50 there were 46 establishments wholly or mainly engaged in manufacture of paper-bags (including bags of transparent cellulose), employing 1,029 persons; in 1948-49 46 establishments employed 1,100 persons. Nearly three-fifths of the establishments each employed not more than 20 persons. The eight largest establishments employed about half of the employment of the 46 establishments. In addition to establishments primarily concerned with paper bags, there are several large producers among companies primarily concerned with printing or stationery manufacture. Most of the establishments have machines equipped for printing of bags. Only three companies, with four establishments, make large multiwall bags for packing of cement, lime, bottled beer, fertiliser, milk powder, minerals, etc.

OTHER PAPER CONVERTING: In 1949-50 there were 57 establishments engaged wholly or mainly in varied activities associated with the printing and allied trades, employing 796 persons; in 1948-49 53 establishments employed 755 persons. Most establishments so classified appear to be paper converters. Only 10 of the establishments each employed more than 20 persons. The activities include the following—

Pasteboards: Two manufacturers, one a specialist.

Suitcase-board, Nitrocellulose-lacquered: Two manufacturers, one using board made by an associate company (see Chapter 4), the other pasting its board from bought-in materials (the latter manufacturer is associated with a pasteboard manufacturer). Both make embossed boards as well as plain.

Coated Papers and Boards: Three brush-coaters. Two are associated companies (see Associated Pulp and Paper Mills Ltd., Chapter 4), one mainly concerned with coated papers, the other with boards and cover papers; both are associated with a U.K. coating company. The other coater is a large printer and container maker, and coats mainly for own use, particularly for production of cigarette cartons.

Gummed Printing: One manufacturer, also making pasteboards.

Varnishing of Printed Work: A few specialised service businesses to printers not equipped for varnishing. One of the businesses also does end-gumming of printed work.

Paper Sensitising for Blueprinting, etc.: About five companies, one of which operates three establishments and one other of which operates two establishments.

Paper Cutting (trade service): A few companies,

Slitting/rewinding and sheeting of newsprint reel-ends: A few companies.

Wastepaper Sorting: A few establishments.

Shredded Paper: Two manufacturers, both also wastepaper collectors and merchants.

Paper Patterns Manufacture: Nine companies, five of which model their patterns, three import master patterns, and one imports patterns printed in outline for cutting in Australia. Four of the companies are branches of overseas manufacturers.

Textile Paper Accessories: One company, with two establishments; the company is directly associated with one of the world's largest manufacturers of cones, tubes, pirns, etc.

THE PRINTING INDUSTRY

There are about 1,600 establishments in Australia wholly or mainly engaged in one or more of the principal processes of printing—letterpress, offset-lithography, intaglio-gravure—or in services to those sections conducting the activities of bookbinding, typesetting, stereotyping and electrotyping, process-engraving, offset-litho platemaking. Silk-screen printing is as yet small in extent (textile printing is not included here—see Chapter 15), but has developed quickly. Intaglio printing other than gravure is quite small in extent, mainly confined to banknote printing.

Integrated establishments—from typesetting to finishing operations—are the general rule. In many instances, however, mainly in small printshops, the typesetting is limited to handset work, the solid setting being obtained from trade typesetters. Similarly in many instances large runs of folding, stapling, sewing, and binding of books from the folding stage, are placed by printers with trade bookbinders. Few printing establishments other than the large newspapers do their own process-engraving, and rely on the specialised trade service of process-engravers, usually specialist in that activity. Similarly, all except a few printshops obtain stereotypes and electrotypes from trade-service establishments, usually specialist in the activity, sometimes part of or associated in company structure with a trade-typesetting service; stereotypers are frequently associated with a process-engraver by proximity (in the same building or nearby) for joint convenience of operations.

All daily newspapers, some weekly newspapers, and all the major weekly magazines of Australia-wide circulation, are self-contained for their principal activity, except that to almost entire extent advertising of a State-wide or Australia-wide coverage is supplied to newspapers in flat stereotype for letterpress printing and in made-up ready-to-photograph condition for offset-litho and gravure printing.

A substantial number (not approximately known) of establishments statistically classified as printers are also engaged to lesser extent in paper converting, usually in limited range of products and usually printed. Cartons are the principal type of product. Stationery products include envelopes, account books, greeting cards and playing cards.

Establishments wholly or primarily concerned with production of printed matter for their own requirements are not uncommon; four examples are a large works for wrapper printing, box and carton making, part of the largest confectionery manufacturing company in Australia, a photographic materials, and printing and developing company printing and making-up its packets and boxes, a soap-wrapper and carton works of a principal soapmaking company, a label and leaflet printing works of a manufacturer and packer selling household grocery and medicine lines door-to-door.

The employment size of establishments wholly or mainly engaged in printing, or as trade service establishments, and total employment of those establishments, were as follows in 1948-49—

ESTABLISHMENT SIZE:	Up to 10 Persons		11-20 Persons		21-50 Persons		51-100 Persons		Over 100 Persons		Total	
	Est.	Pers.	Est.	Pers.	Est.	Pers.	Est.	Pers.	Est.	Pers.	Est.	Pers.
Printing—												
Government	1	8	3	46	1	33	3	253	8	2,593	16	2,933
Newspaper (a)	287	1,387	65	924	43	1,354	17	1,206	18	6,747	430	11,618
General (b)	653	3,021	180	2,640	149	4,577	46	3,247	25	4,553	1,053	18,038
Stereotyping, Electro- typing	18	106	4	58	3	97	1	67	—	—	26	328
Process Engraving (c)	20	112	15	243	24	752	2	116	—	—	61	1,223
Totals	979	4,634	267	3,911	220	6,813	69	4,889	51	13,893	1,586	34,140

- (a) Includes all establishments primarily concerned with printing newspapers and/or periodicals, including those which also carry out general job printing; but where job printing is carried on as a sizable activity as well as newspaper production and is separately accounted for in company accounting, the job-printing is usually statistically listed as a general printing establishment separate to the newspaper section.
- (b) Includes all establishments engaged wholly or mainly in trade typesetting, bookbinding, ruling.
- (c) Includes offset-litho platemaking.

Similar statistics are not yet available for 1949-50. The total numbers of establishments and the persons employed for each activity in 1949-50 were as follows: Newspaper Printing, 424 establishments, 12,723 persons; Government Printing, 16 establishments, 2,999 persons; General Printing, 1,076 establishments, 12,824 persons; Stereotyping and Electrotyping, 25 establishments, 336 persons; Process and Photo-engraving, 67 establishments, 1,331 persons. The totals for 1949-50 were 1,606 establishments, 30,213 persons.

GOVERNMENT PRINTERS: Principal establishments are those of the Commonwealth Printer (one), the Commonwealth Bank (one, printing banknotes, stamps, postal notes, etc.), the six State Government Printers (operating between them 10 establishments). Two State Railways also operate printing establishments. The Commonwealth Printing Works at Canberra and the State Printing Works at Sydney and Melbourne, are among the largest printing works in Australia.

NEWSPAPER AND PERIODICAL PRINTERS: 424 establishments were listed in 1949-50 as being primarily concerned with production of newspapers and/or periodicals, and employed 12,723 persons. In 1948-49, 430 establishments employed 11,618 persons. (Journalist and editorial staff is not included in employment, which is limited to printing (composing, reading, machinery, binding, etc.) and issuing staff.) Nearly three-fifths of employment was in the 18 largest establishments.

There are 16 capital-city daily newspapers (Monday to Saturday inclusive), most with a wide circulation in the State in which published; and 35 daily newspapers of a provincial character, each serving a large country city or town and the surrounding countryside. In addition there is one suburban daily newspaper of limited circulation, published in Sydney, and a shipping-news daily is published in each of the State capital cities except Hobart. The daily newspaper publishers each own and operate the printing establishment or establishments at which the newspaper and/or associated periodicals are printed.

The following table provides certain information relating to the 16 capital-city daily newspapers, which (excluding Sunday editions) account for about 90 per cent. of Australian daily-newspaper circulation. The table also provides information relating to Sunday editions or newspaper circulation. The table also provides information relating to Sunday editions or Sunday newspapers and other principal weekly or monthly journals printed and published by the 16 capital-city daily newspaper publishers/printers. Publication of Sunday newspapers is not legal in every State. The Brisbane morning daily and three of the Sydney dailies publish Sunday editions. The fourth Sydney daily is associated with a weekly paper which varies its contents from State to State and is printed in Sydney and Brisbane and published on Sunday, and for Victoria, South Australia and Tasmania (three separate editions) is printed in Melbourne and published in the three States on days of the week other than Sunday. The Adelaide evening daily publishes a weekly late on Saturdays. An independent Sunday paper is printed and published in Perth by a company which also produces two weeklies on Saturday. Melbourne, Adelaide, Hobart and Canberra do not have newspapers printed and published in those cities for sale on Sundays.

Publishing/Printing Company, Capital City and State	Daily Newspaper (not Sunday) and Sunday Equivalent, and Circulation (a)	Principal Additional Publications (b) and Circulation (a)
Canberra, A.C.T. Federal Capital Press of Australia Ltd.	"The Canberra Times" (morning, 5,360 (c))	
Sydney, N.S.W. John Fairfax & Sons Pty. Ltd.	"The Sydney Morning Herald" (morning, 312,000 (c))	"The Australian Financial Review" (See also "Woman's Day and Home", below) (weekly, 11,000)
Consolidated Press Ltd. . .	"The Sunday Herald" (305,000 (c)) "The Daily Telegraph" (morn- ing, 310,000)	"The Australian Women's Weekly" (725,000) "Australian Monthly" (228,522)
Associated Newspapers Ltd.	"The Sunday Telegraph" (482,000) "The Sun" (afternoon, 286,000) "The Sunday Sun" (453,913)	"Woman" (weekly, 282,657) "Pix" (weekly, 316,576) "People" (fortnightly, 259,595) "Sporting Life" (monthly, 154,096)

Publishing/Printing Company, Capital City and State	Daily Newspaper (not Sunday) and Sunday Equivalent, and Circulation (a)	Principal Additional Publications (b) and Circulation (a)
Truth & Sportsman Ltd. . .	"The Daily Mirror" (afternoon, 283,711) "Truth" (Sunday, Sydney, 408,156)	"Truth" (Brisbane, 157,424; Melbourne, 226,071; Adelaide, 37,488; Hobart, 15,368) "Sportsman" (Sydney, 34,466)
Melbourne, Vic. Herald & Weekly Times Ltd.	"The Herald" (afternoon, 408,500) "The Sun News-Pictorial" (morn- ing, 415,498)	"Woman's Day and Home" (weekly, 246,185— see footnote (d) below) "Sporting Globe" (Wednesday, 124,281; Satur- day, 165,330) "Listener In" (weekly, 69,585) "Weekly Times" (81,761) "Australasian Post" (weekly, 61,441) "Woman's World" (monthly, 80,000 (c)) "The Leader" (weekly, 21,150 (c))
Argus & Australasian Ltd.	"The Argus" (morning, 159,527)	
David Syme & Co. Ltd. . .	"The Age" (morning, 136,626)	
Brisbane, Qld. Queensland Newspapers Pty. Ltd.	"The Courier-Mail" (morning, 193,506) "The Sunday Mail" (253,736) "The Brisbane Telegraph" (after- noon, 142,454)	— —
Adelaide, S.A. Advertiser Newspapers Ltd. News Ltd.	"The Advertiser" (morning, 158,129) "The News" (afternoon, 101,671) "The Mail" (late Saturday even- ing, 163,788)	"The Chronicle" (weekly, 20,687) "Radio Call" (weekly, 22,837)
Perth, W.A. West Australian Newspapers Ltd. Perth Newspapers Ltd. . .	"The West Australian" (morning, 123,886) "The Daily News" (afternoon, 87,183)	"The Western Mail" (weekly, 26,705) "The Broadcaster" (weekly, 42,049) —
Hobart, Tas. Davies Bros. Ltd.	"The Mercury" (morning, 40,754)	—

- (a) Circulations, unless noted to footnote (c), are as published by Audit Bureau of Circulations, and are the average circulation for each issue for six months ending 31/3/52.
 (b) This list is indicative of the more important periodicals printed and published by daily-newspaper companies, but does not include all periodicals published by some of the companies.
 (c) Claimed circulation (not member of Audit Bureau of Circulations).
 (d) Printed by Herald Gravure Pty. Ltd. (a subsidiary company of Herald & Weekly Times Ltd.), Melbourne, for Herald & Weekly Times Ltd. and John Fairfax & Sons Pty. Ltd.

The total circulation of the 51 daily newspapers (excluding Sunday editions)—16 capital-city dailies and 35 provincial dailies—averaged for each issue in the six-months' period ended 31/3/52, was about 3,609,500 copies. The capital-city daily-press circulation was about 3,247,700 copies, or about 90 per cent. of the total; and the provincial daily-press circulation was about 361,800 copies or about 10 per cent. of the total. Of the capital-city daily-press circulation, 1,858,200 copies were of morning dailies, or 57 per cent.; and 1,389,500 copies were of afternoon dailies, or 43 per cent.

Several of the daily-newspaper companies are associated financially, either directly (by investment) or indirectly (by director or directors on two or more boards); one Melbourne daily, "The Argus", is a subsidiary company of a prominent U.K. newspaper company (publishing the London "Daily Mirror"). There are associations between various daily-newspaper companies in different capital cities of Australia for the interchange of news and syndicated matter. Most of the capital-city daily newspapers have either controlling or substantial interests in radio-broadcasting stations ("B" class stations, city and provincial, which are commercial stations, supported by advertising).

The provincial daily newspapers are all printed and published at the provincial area each covers, and with few exceptions the newspaper (including printing plant) is owned by a company local to the provincial area.

The printing and publishing of weekly, monthly, etc., journals by companies primarily concerned with daily-newspaper production is established to the extent that the journals of largest national circulation in Australia are printed and published by such companies. A few journals of national circulation are printed and published by companies not engaged in daily-newspaper production; and at least one magazine of large national circulation is printed by a daily-newspaper company, but is not published by that company.

General printing (other than journal printing) by daily-newspaper companies is usual with such companies at provincial cities and with some of the daily-newspaper companies at the smaller capital cities; however, one large daily newspaper company, Advertiser Newspapers Ltd., Adelaide, S.A., operates one of the largest and most modern establishments in Australia for general and book printing, using letterpress and offset-lithography.

Most of the establishments classified in official statistics as newspaper and periodical printers are suburban and country newspaper companies or businesses each operating its own plant for printing the newspaper or newspapers, and usually also considerably engaged in general printing. Also included are metropolitan establishments primarily concerned with printing and

publishing a newspaper or periodical, some of which have national circulation; several such establishments are operated by churches, trade unions, political parties, etc.

In capital-city suburbs, printing and publishing of more than one suburban newspaper, sometimes several, is not uncommon; there is one "chain" in Sydney that is conspicuous. It is not uncommon for suburban newspapers to be free and delivered to each residence and shop in the area concerned, the only income towards such production being from advertising. Some suburban and country newspapers are not printed by the publisher, but usually by a printer who is also a printer and publisher of such newspapers. There are instances where two or a few country newspapers, each printed and published at the town or provincial city of principal distribution, are owned (plants and publications) by the one owner. A "chain" that is conspicuous comprises nine newspapers, one a daily, each of which is a separate entity in its local printing, administration and function, but all of which are grouped into one co-operative group with financial links, five of the newspapers, including the daily, are printed and published at towns situated on or near the River Murray, and two are printed and published at towns situated on two major tributaries to the River Murray; these seven newspapers, spread out over about 380 miles throughout the so-called "Murray Valley", derive from that major water system and its extensive irrigation areas an interest and concern common to each of the newspapers.

JOB (GENERAL) PRINTING, TYPESETTING, BOOKBINDING, PAPER-RULING: In 1949-50 there were 1,076 establishments wholly or mainly concerned with printing (as a partly or fully integrated activity, from typesetting or plate preparation to bookbinding), or with typesetting, bookbinding, paper-ruling, employing 18,491 persons. In 1948-49 1,053 establishments employed 18,034 persons.

The printing industry proper consists mainly of establishments that combine more than one of the essential operations in production of printed matter: the preparation of printing medium (type-forme, offset-lithography plate, gravure plate or cylinder), the actual printing, and the finishing of product after printing, is the usual organisation of most printing establishments. The industry's activities are carried out by many independent units of continuous gradation in size from the one-man printshop to very large establishments concerned with massive one-company service providing an extensive range of printed matter, containers and other paper products. The 25 establishments each employing over 100 persons (see table above), 4,550 persons in all, comprised one-quarter of employment in job printing; the establishments with not more than 50 employees made up just on three-fifths of the activity.

Specialist activity is carried on, and is extending. Private printing establishments, those operated by a manufacturer for production of all or portion of the printed matter required in the principal activity, are not uncommon, but are small in collective effect relative to the job-printing industry generally. Installations of small offset-litho presses in offices and factories, mainly for production of routine forms, are fairly numerous.

Letterpress Printing:

Comprises about 90 per cent. of the job-printing industry.

Offset-Lithography Printing (excluding small-machine office installations, and Government printers): About 80 establishments.

In general the letterpress printer uses only that process, and tends to specialise on certain types of work; the greater number are printers of commercial work and a relatively small number concentrate on high-grade colour work, bookwork, or work requiring careful typographical treatment such as business letterheads of quality. Association of letterpress and offset-lithography in the one printing establishment is commonplace among the establishments using the offset-lithography process; there are

several establishments, some large, engaged wholly or almost so with offset-lithography printing, but the greater part of capacity is in large shops using both letterpress and offset-lithography. Most lithographers are equipped for preparation of copy for platemaking, but it is mainly the larger companies that are equipped to make their own printing plates and have step-and-repeat machines for laying down multiple images on the one plate in register for colour printing in two, three or four printings.

Gravure Printing: About eight companies. Three are daily-newspaper companies or subsidiary companies of those companies, with reel-fed multicolour rotogravure presses (printing from cylinders), primarily in each instance to produce a weekly women's journal of Australia-wide circulation (one of these journals is printed jointly for the daily-newspaper company owning the printing establishment and another daily-newspaper company that does not have a rotogravure printing unit); the three companies also each print other national-circulation publications by rotogravure. — Two jobbing printers have sheet-fed gravure units; one is a specialist in the activity (but associated with a letterpress-printing company and a process-engraving business) and does a wide range of work, on single-colour units printing from plates (the company also prepares photogravure plates and cylinders, particularly for units used in printing small packets at high-speed, plastics films, etc.); the other is one of the largest offset-lithography printers in Australia, and has a dual-purpose single-colour gravure press, printing from plates or cylinders, used for label printing, particularly printing of metallic colours on hard-surfaced and glossy papers (such as flint paper), for which the gravure process is well suited. — Two companies which are the principal printers and converters of transparent-cellulose film and aluminium foil in Australia, particularly for food packaging, each operate a multi-colour gravure press, printing from cylinders, particularly for cellulose-film printing. — In addition to the above, there are in operation here and there throughout Australia special machines for packaging which have an incorporated gravure-printing section (for example, a razor-blade packing machine). One of the largest producers of calendered P.V.C. film prints the film by rotogravure and silk-screen processes, and another major producer of plastics films and nitrocellulose-coated fabrics uses gravure printing for surface patterning.

Intaglio Printing other than Gravure: In use mainly at the Note Printing Branch of the Commonwealth Bank, where all banknotes, stamps and postal notes for the Commonwealth are printed; the process is used for the detailed line work of banknotes and for stamp issues from time to time. — The printing of high-grade business and personal cards, letterheads, personal note-paper, etc., from intaglio plates, is done by several printers at capital cities, but the overall demand is very small.

Silk-screen Printing (other than of textiles): About 130 establishments, about half of which are silk-screen sections of signwriting shops and the remainder mostly specialist. Most are small in size as yet. Only a few printers using letterpress and/or offset-lithography have also taken on silk-screen printing.

Transfers (Decalcomania) Printing: About five printers, principally a company associated with Canadian and U.S.A. transfer printers and with an Australian general-printing company. One of the producers, using the silk-screen process, is associated with a long-established signwriting business. The principal producer uses offset-lithography, letterpress and silk-screen, mainly offset lithography.

(Wallpaper Printing is not established in Australia. Textile printing, silk-screen and roller, is well established—see Chapter 15.)

Trade Typesetting: About 30 companies or businesses, medium to small in size, are primarily concerned with trade typesetting. Most use slug-casting machines only, but a few have a "Monotype" type-setting service as well; there are also a few trade shops that provide only "Monotype" service. Practically all the larger trade typesetters provide display types, made-up jobs and formes, reproduction proofs, some being considerably engaged in such service, particularly to advertising agencies. A few also operate a stereotype section or work in close association with a stereotyper. — Some printing establishments with surplus composing-room capacity undertake trade machine-composition and occasionally make up as well.

Stereotyping and Electrotyping: About 25 companies or businesses, medium to small in size, are primarily concerned with stereotyping as a trade service. Electrotyping in copper or nickel as a trade-service activity is almost invariably carried on by a stereotyper, but there are only about twelve trade electrotypers, much of the electrotyping being done by one company with two factory establishments, one in Melbourne, Vic., and one in Sydney, N.S.W., and most of the remainder by three stereotypers and electrotypers in Melbourne and three in Sydney. Stereotypers are frequently associated with process-engravers in furtherance of their trade service, but are not necessarily financially associated. (See next activity.) The jobbing printing industry relies almost entirely upon the trade service for stereotypes and electrotypes, few jobbing printers doing this work themselves. Newspapers and journals printed by rotary letterpress invariably make their own stereotypes (curved plates), as such is essentially an integral part of the activity.

Process Engraving and Litho-plate Making: About 70 companies or businesses, medium to small in size. Engraving of letterpress line and half-tone blocks is in most instances the only or principal activity. Most process-engravers work in close association with a stereotyping and electrotyping company or business, usually established in the same building or nearby; the companies are not necessarily financially associated and are usually entirely separate in that way. There are about 14 offset-lithography platemakers for trade service, only three of which are specialists, the others being also half-tone process-engravers. Most large users of litho-plates make their own plates, but few letterpress printers other than daily and other large newspapers undertake their own process-engraving work.

Paper-ruling: A few specialist rulers, mostly small. The greater part of trade ruling is done by trade bookbinders with ruling capacity.

Bookbinding, General and Edition: About 50 companies and businesses primarily concerned with trade service. (Some printers handle trade work as an incidental activity.) Most trade bookbinders offer a general jobbing service of which formal bookbinding is often the lesser activity compared with ruling, folding, stapling, numbering, quarter-binding, etc. Only two trade-binders are equipped for edition bookbinding in sizable continuing quantity (most edition binding in Australia being done by the book printers).

Varnishing, Waxing, End-gumming, of Printed Work: A few businesses in Sydney and Melbourne provide a trade service for these finishing operations. (Most printing of waxed papers is done by the waxers, however, as an integrated activity. Most large printers of labels also do their own varnishing.)

Miscellaneous Activities: Gold-blocking and rubber-stamp making are carried out mainly by small businesses in the capital cities, usually specialists in each activity.

SIGNWRITING

No statistics exist for the activity of signwriting. Most signwriting is done as a tradesman activity, but in each capital city, there are a few workshops where signs, either singly or in number, small to large in size, are made (including electric-neon signs), and where the silk-screen process is in normal use.

PHOTOGRAPHIC MATERIALS AND PROCESSING

In 1949-50 there were about 78 companies or businesses wholly or mainly engaged in photography processing, and employing 2,360 persons. In 1948-49 about 77 establishments employed 2,353 persons. Of those establishments 37 each employed up to 10 persons, 16 each from 11 to 20 persons, 19 each from 21 to 50 persons, 2 each from 51 to 100 persons, and 3 each more than 100 persons; the latter 3 establishments employed 1,227 persons, nearly half of the total employment.

Film, Plate and Paper Sensitising: One company only (excluding paper for blueprinting, dyeline, etc.), with branch factories in New South Wales and Victoria. The company, Kodak (A'asia) Pty. Ltd., is the only manufacturer in the Southern Hemisphere of photographic emulsions, and is the only preparator (including packaging) of sensitised films, plates and photographic-print paper in Australia. Also prepared are processing chemical compounds for developing and printing for general sale, and filters, mounts, dark-room equipment and camera accessories are made. Developing and printing are carried out on a large scale. (A large wholesale and retail selling organisation is also operated.)

Developing and Printing: Six organisations or businesses develop their own film and film strip (and are otherwise not actively engaged in the photographic-material and processing industry). In addition to Kodak (see above), about 70 establishments large enough to be classified as a factory are engaged in developing and printing of snapshots, etc. (and there would be a large number of small establishments similarly engaged, but not large enough to be classified as a factory).

Screen Slides: Several manufacturers, mainly a few at each capital city, and mostly specialising in the activity.

(The filming of motion pictures, film-strip, etc., is not included in the classification of manufacturing activities in Australia.)

Part Two: Outline of Capacity of Manufacturing Activities

PAPER AND PAPERBOARD CONVERTING, AND PRINTING AND BINDING

THE converting and printing industries are commonly described in Australia as the "printing and allied trades". "Printing" describes an industry beginning at typesetting or plate preparation and finishing with an end-use product. "Allied" describes the converting industry in its varied entirety—the manufacture of paper and paperboard in intermediate or processed forms (clay-coated; laminated; corrugated and solid container-board; embossed; waxed; etc.) for printing and/or fabricating, and paper and paperboard products, printed or not printed, for containing, fastening, tagging, forming, for toilet purposes, for protection and/or ornament, for "stationery". (See Part One of this chapter for comment on application of "stationery" as a description of product.)

There are numerous instances of specialisation by companies or businesses within the "printing and allied trades", but association within the one company or business of two or more of the activities within converting and printing is so commonplace as to provide affinity throughout. (Of recent years, silk-screen printing is providing a developing link between the printing trade and the signwriting trade.)

The value of output by the converting and printing industries in 1949-50 was £72.1 millions, of which total, materials, fuel, etc., used, made up £35.9 millions. In 1948-49 value of output was £59.2 millions of which total, materials, fuel, etc., used, made up £29.7 millions. No separation exists in official statistics of consumption of paper and paperboard between the converting industry (or any of its compo-

nent activities) and the printing industry; a comparison of value of "power, fuel, materials" used in 1949-50 suggests that about two-thirds of total paper and paperboard (by far the principal material used) is used in the printing industry and one-third in the converting industry. (See also Part Two of Chapter 4, "Pulp, Paper, Paperboard" for details of availability — production and imports — of paper and paperboard in 1948-49.)

The official statistics of production by the converting and printing industries are very limited as to details of materials used and articles produced. The full information concerning materials used in 1948-49 is as follows—

MATERIALS USED:	1948-49	
	tons	£
Newsprint	137,911	7,033,185
Cigarette paper (bulk)	480	—
Other paper	—	10,814,891
Cardboard	—	4,306,799

Comment on capacity of the various activities within the two broad industries is set out below under the following headings—

Converting of Paper and Paperboard

Processed Paper and Paperboard
Stationery
Containers
Other Products

Printing

Integrated Printing
Trades Services

CONVERTING OF PAPER AND PAPERBOARD

Manufacture of paper and paperboard products has been long established in Australia. The industry had its origin mainly as part of the development of the printing industry; writing materials, account books and similar orthodox items of stationery were the principal products. The industry naturally extended into machine-made bags, boxes, cartons and other containers as manufacture of those products became mechanised, and imported or built itself semi-automatic and automatic plant for various other products of large demand, such as writing tablets, exercise books, toilet rolls, cigarette paper in packets, textile cones and tubes. Manufacture of processed paper and paperboard was a relatively late development that expanded quickly.

Established paper-converting capacity is capable of meeting Australia's needs for most of the products made by the industry (see Part One). Expansion during recent years has been steady in consequence of rapidly increasing domestic consumption of paper and paperboard products (including packaging for export goods) and increasing export of products to nearby markets. Shortage of labour and materials, especially container-board materials, prevented full use of established capacity in the

later post-war years to the end of 1951. Labour, paper and paperboard supplies became adequate by early 1952, because of very large imports in 1951 and early 1952 and because demand for converted products had fallen a little.

A little more than half of the converting industry is, by employment, in the container activity—boxes, cartons, cups, tubs, cans, bags. Most of the remainder of employment is engaged in the activity carried on by "manufacturing stationers" (so described), which although principally concerned with orthodox stationery also make other paper end-products. A not insignificant and growing proportion is employed in production of processed paper and paperboard and certain miscellaneous end-products.

Processed Paper and Paperboard

The term "processed" as applied to paper and paperboard is not one in general use in the paper-converting and printing industries for the products so described in this study. It is here adopted as a suitable overall description of paper and paperboard products that after processing remain a paper or board material for printing and/or fabricating. The principal processed material is undoubtedly

container board, corrugated and solid. Others are pasteboards, suitcase-board, art printing paper and board, gummed printing paper, gummed tape, plain waxed wrapping, plain waxed boards.

CONTAINER-BOARD is made up in Australia entirely by fibre-container manufacturers. ("Fibre" denotes a shipping container made of paperboard in contrast to one made of wood, of which shipping containers were usually made previous to the development of the paperboard outer container. It also denotes that the material used is mostly of new fibre, and chemical-pulp fibre at that, for strength, in contrast to the very large proportion of wastepaper of groundwood-pulp origin (such as newsprint) used in making boards for cardboard cartons and "set-up" (rigid and semi-rigid) cardboard boxes.)

Output of container-board and the quantities of liner, corrugating paper and filler-board used in manufacture of container-board, are not given in official statistics. All materials other than test-liner (a material which is lower in strength than kraft liner, but strong enough to meet a standard test for the product) are made in Australia. Most of these materials are now (June, 1952) available in sufficient quantity to meet present requirements, which is thought to be well below potential demand; per-capita consumption of container-board in Australia is stated by the principal manufacturer of container-board materials in Australia to be only one-seventh of consumption in the U.S.A. (See Chapter 4, "Pulp, Paper, Paper-board" for comment on extension of capacity to make container-board materials in Australia.)

Imports of materials and of container-board, all of which were difficult to obtain in desired quantity overseas, have been as follows—

IMPORTS:	1949-50		1950-51	
	tons	£	tons	£
Kraft liner	3,407	201,379	5,020	361,347
Jute (chip) liner	11	671	14	6,853
Test liner	201	11,354	1,308	80,291
Corrugating paper and strawpaper	816	33,298	1,634	81,584
Corrugated container-board, single or double-faced	508	36,944	109	5,288
Filler board (chip)	386	18,942	815	50,822

According to a trade report, substantial tonnages of solid-fibre board were being imported but import restrictions (see Appendix II) have reduced quantities imported during the first six months of 1952. Unfortunately a separate statistical item has not been made for solid-fibre container-board, the imports of which are included among the miscellaneous paper-boards item. The imports of corrugated container-board are very small relative to production in Australia, and probably consist of special types.

Plant capacity for container-board manufacture is being steadily extended, despite shortages of container-board materials that have occurred from time to time. Whilst some of the corrugating plant is old in type or relatively slow, the largest latest installations are of modern high-speed machines from the U.K. and the U.S.A. Most of the solid-fibre pasters in use are Australian-made to modern pattern.

Production of GUMMED PRINTING PAPER in Australia is limited to one manufacturer (also making pasteboards), and output is not disclosed. Other sheet-gumming capacity is stated to exist, but is not in use. Imports,

mainly from a long-established high-reputation manufacturer in the United Kingdom, have been as follows—

IMPORTS:	1949-50		1950-51	
	tons	£	tons	£
Gummed paper in sheets or flat shapes	127	56,096	292	143,880
Gummed paper in rolls of any width	36	14,438	67	15,471
Totals	163	£70,534	359	£159,351

A small amount of gummed paper in rolls has been exported, mainly to New Zealand.

GUMMED TAPE production is increasing in keeping with the increased manufacture of fibre containers (for which the tape is used to "stay" the corners and joins). Capacity has been a little behind demand, mainly because of shortage of glue; this led to rising imports, but such are negligible compared with production, which in 1948-49 was valued at £192,030.

Capacity for production of COATED PAPERS AND BOARDS in Australia has been small, but was extended substantially over recent years. Principal product has been a widely-used line of embossed cover paper, with a small output of coated printing paper. Output of coated printing paper and boards has been considerably increased with the use of newly-established capacity, and is expected to meet the demand in Australia for brush-coated papers and boards—other than for preferred or specialty papers and boards which will continue to be imported. Imports have been as follows—

IMPORTS:	1949-50		1950-51	
	tons	£	tons	£
Coated printing paper (other than machine-process coated)	1,335	170,748	3,146	437,559
Surface-coated boards	136	14,240	208	24,475
Totals	1,471	£184,088	3,354	£462,034

Imports in 1949-50 and 1950-51 of other processed papers, consisting of "surface-coated paper, not elsewhere included, plain or embossed; marble paper; boxmakers' fancy papers, having printed or embossed designs thereon", were 247 tons valued at £82,259 and 845 tons valued at £242,871. Marble paper, end papers, and a limited range of box-makers' fancy papers, are made in Australia. Quantity produced is not known. The overall range of such processed papers produced in Australia is apparently not sufficient to satisfy the requirements of users. (See "Printing", later, for comment on wallpaper.)

PASTEBOARDS of ordinary white and manilla types are made in Australia by two manufacturers, mainly from Australian-made materials, namely MF. printing (with grey-board filler for heavy boards) for white pasteboards up to 10-sheet, and M.G. sulphite for document and tag-manilla pasteboards. Index boards and other system boards are not made in Australia. Output of pasteboards in Australia is not given in official statistics. Imports have been as follows—

IMPORTS:	1949-50		1950-51	
	tons	£	tons	£
Pasteboard	31	3,367	317	30,438
Index or system boards	429	49,359	741	100,081
Ivory boards	156	17,657	245	36,678
Totals (a)	616	£70,383	1,303	£167,197

(a) Other types of pasted boards are included with other items and therefore obscured.

A limited amount of paste-lining of carton boards has been undertaken, also lining of strawboards for "set-up" boxes. Practically all

lined carton boards used in Australia are vat-lined boards direct from the paperboard machine.

Capacity for WAXING of plain or printed wraps and of boards is being expanded and appears adequate to the steadily increasing demand provided paper, the lighter weights of which are all imported, is in adequate supply. The output of waxed papers and boards is not given in official statistics. Imports of waxing papers are substantial in tonnage. (There are two statistical items covering imports of waxing papers, but it is obvious from the relatively low imports shown by those items that the greater quantity of waxing papers are being included among other items of tissue and sulphite papers.) Imports of waxed papers in 1949-50 and 1950-51 were valued at £8,024 and £5,623.

Stationery

See Part One of this chapter for description of products of manufacturing stationers in Australia.

Capacity to make stationery in Australia appears to be well related to demand. The principal manufacturers are vigorous in the activity, well equipped in plant, and several of them are directly in touch with demand through their own retail outlets. A shortage of labour in the postwar years has been a hindrance (and one which has contributed substantially to noticeable shortages of envelopes from time to time). The labour position improved in early 1952. Uncertain paper supply has caused production to fluctuate, but supply is now adequate (June, 1952). The value of output in 1949-50 of the few items for which official statistics are collected was as follows—

PRODUCTION:	1949-50
Envelopes	£1,021,239
Writing pads	362,951
Exercise books; registers; books of account	1,034,567

Total value of output in 1949-50 of establishments listed statistically as manufacturing stationers was £8.1 millions, of which £4.6 millions, was for materials, power, fuel, etc. Included in the value of output, however, is substantial production of products that are not orthodox stationery, such as waxed papers and boards, toilet paper, etc.

Imports of stationery have been as follows—

IMPORTS:	1949-50	1950-51
Envelopes (unprinted), writing tablets and boxes or packets containing envelopes and note paper	£84,339	£78,759
Books: Account, betting, cheque, copy, copying, drawing, exercise, guard, letter, memorandum, pocket, receipt, sketch and the like	22,217	36,493
Book covers and loose-leaf binders, principally of paper or paperboard	24,084	24,532
Diaries	18,790	28,621
Billheads, memorandum forms, and all other ruled or engraved forms of paper, n.e.i., including printed envelopes	6,552	7,358
Stationery manufactured principally from paper or board, not elsewhere included	95,118	151,859
Totals of above items	£251,100	£327,622

Exports of "stationery manufactured principally from paper or board" amounted to a value of £93,070 in 1949-50 and £89,316 in 1950-51; all except £3,888 of the 1950-51 exports being for goods of Australian production.

Manufacture of CARBON-PAPER is well established but is a little short of demand. All paper for carbon-paper manufacture is imported other than a lightweight kraft for one-time carbon. Imports of carbon-paper in 1949-50 and 1950-51 were 36 tons valued at £33,564 and 61 tons valued at £57,538. Restrictions of imports (see Appendix II) will increase the shortage towards the end of 1952.

There is adequate capacity in Australia to make up TYPEWRITER STENCILS. Imports of stencils and stencil paper (both included together in the one statistical item and not separated) in 1949-50 and 1950-51 were 94 tons valued at £62,483 and 127 tons valued at £93,227.

Containers (including Paper Bags)

The supply of containers made of paper and/or paperboard (like much of the supply of printed matter) is very much a local activity in Australia, and imported containers have not been other than a minor part of total supply. The industry has developed with a steady demand, and expanded further with the need for modern packaging, particularly for cartons for individual packs, and for fibre-board containers in place of wooden cases.

The early establishment in Australia of the manufacture of box and carton boards, the timely entry into manufacture of kraft papers and fibre container-board materials, and considerable overall expansion in output of all paperboards and wrappings, have been really substantial factors helping to raise the paper and paperboard container industry in Australia to a mature level.

In recent years, the greatest expansion has taken place in the fibre-container and the carton sections (both containers being frequently complementary in use—the fibre-container as the carrier container, the carton as the product container, frequently in consumer pack). The pronounced shortage of tinsplate has caused some large users of cans made of tinsplate to use to greater extent paperboard cans with metal ends and lid.

Transparent cellulose has become prominent as a bag container and as a wrap for other containers, and converters mainly concerned only with the material have become well established.

The industry is well equipped, and as demand rises to economic levels for various types of containers (including paper-bags), has no hesitation in ordering specialised automatic high-speed machinery and equipment to cope with the demand.

The industry is large enough to be complementary throughout, with large full-service establishments down to small specialist shops making a limited range of boxes. Some big users, such as breakfast cereal makers, operate their own container plants, either directly or through a subsidiary company. Integration between job printing and carton manufacture is widespread, making it difficult to determine a demarcation line between the printing industry proper and the container industry.

Official statistics of production by the container industry provide little separation into detail. Value of output in 1949-50 for the few items recorded was as follows—

PRODUCTION:	1949-50
Cardboard boxes and cartons	£7,688,643
Containers other than boxes, cartons and bags	623,287
Paper bags—	
Cement	} 2,239,935
Otherwise (including transparent cellulose)	

Imports of containers (empty) have been quite small—

IMPORTS:	1949-50		1950-51	
	tons	£	tons	£
Drinking cups	1	456	3	1,234
Other containers—				
Plain	3	1,152	4	1,727
Printed or embossed	84	21,918	86	39,594
Paper bags—				
Plain	10	1,174	79	10,925
Printed or embossed	9	2,271	83	16,601
Totals	107	£26,971	255	£70,081

Exports of bags and other containers (empty) are mainly to Pacific Islands, New Zealand, and near eastern Asia, and have been small—281 tons valued at £45,953 in 1949-50, 377 tons valued at £56,407 in 1950-51. Of the 1950-51 exports 10 tons valued at £1,456 were imported.

Other Products of Paper and Paperboard

Capacity for production of TOILET PAPER in rolls and interleaved packets, SANITARY TISSUES, TOWELLING in rolls and interleaved towels, SERVIETTES, D'OYLEYS, PATTY PANS, CHOCOLATE CUPS, PAPER NOVELTIES, appears to be well related to demand. Production statistics are limited, being as follows, for 1949-50: Toilet paper, £792,499; and "serviettes, towels, etc.", £68,983. Imports have been as follows—

IMPORTS:	1949-50	1950-51
Sanitary tissues and sanitary papers (a)	£20,856	£45,546
Towels and towelling of paper	nil	443
Patty pans, chocolate cups, and similar products	nil	752
Paper novelties	16,983	24,148
Manufactures of paper and of board not elsewhere included (b)	366,065	448,105

(a) Does not include toilet paper.

(b) Does not include cigarette papers, textile paper accessories, or printed matter. Includes toilet paper.

Exports of miscellaneous paper products have been quite small, about £33,242 in value for the year 1949-50 and £34,000 in 1950-51.

The demand for CIGARETTE PAPERS in packets in Australia appears to be adequately catered for by established capacity. Quantity produced in 1949-50 was 8,382 million, valued at £423,857. TUBES are also produced in small quantity. Imports of cigarette papers in packets, and cigarette tubes, in 1949-50 and 1950-51

were valued at £7,400 and £33,976, and exports at £14,507 and £47,657, of which in 1950-51 £9,407 worth was imported. Cigarette paper is not made in Australia. Imports of paper for packeting and for machine-made cigarettes in 1949-50 and 1950-51 were 377 tons valued at £124,177 and 366 tons, £127,607.

The only manufacturer in Australia of TEXTILE PAPER ACCESSORIES—cones, pirns, tubes, etc.—states that its capacity is three times greater than the current demand in Australia and is permitting small exports. Imports of "cones, tubes, bobbins, reels, spools and pirns of paper" in 1949-50 and 1950-51 were 80,172 lbs. valued at £11,049 and 52,032 lbs. valued at £9,480.

The only operating manufacturer in Australia of MOULDED PULP PRODUCTS (excluding papier-mache) is in that activity principally concerned with egg-packing mouldings—"cushion flat" ("Mape's flat"), egg trays of the "Keyes" type, and a retail egg-pack. The company states that it meets the demand for egg-packing mouldings in Australia, which is substantial because of the big export trade in eggs; and is also exporting flats and trays to South Africa and New Zealand. Bottle wraps are also made. The mouldings are those that can be made in large quantity on the automatic pulp-moulding machine (a massive installation) in use. Official statistics of production do not exist, and there is no separate imports/export statistical item for moulded-pulp products. Imports appear to be limited to containers which enter with the goods they contain, such as high-class wines and certain glassware.

Established capacity for production of DRINKING STRAWS is adequate to supply the demand in winter, but shortages occur in summer. Paper shortages have been responsible for shortages in some cases. Overall demand for straws, however, is increasing, contributed to by increased bottling of aerated waters and fruit drinks in "splits" (a bottle of 7½ oz. capacity), with which straws are customarily used instead of the dispenser having to provide a drinking glass. There are no published statistics of production and imports. Capacity for manufacture of straws is being extended, and includes plant for straws of transparent cellulose as well as of paper.

PRINTING

The Australian printing industry had its beginning in each of the infant colonies that later became the present States. As Australia developed the industry kept close to demands on its services, and can be said to have reached maturity not so many years ago when it became a book printer of consequence in service to book publishers in Australia and abroad.

The full range of services possible from a mature industry is available. Three printing processes—letterpress, offset-lithography, intaglio-gravure—are in normal use, with silk-screen provided mainly by specialist activity close to, but not in, the printing industry.

Shortages of paper from time to time, and a steady shortage of journeymen tradesmen, had lengthened the delivery dates of most commercial job printing, and of book printing, but a lessening of demand early in 1952 has improved the delivery. All tradesmen industries are experiencing a disturbing shortage of apprentices; the printing industry is able to attract more apprentices than other industries, but remains short of requirements.

There are no official statistics giving details of products made by the printing industry proper and the record of materials used is combined with that of paper converting (see introduction to this Part).

The value of output in 1949-50 of the industry, including the trade-service sections, was £51.6 millions, of which £23.7 millions was for materials, power, fuel, etc.

The industry has been considerably affected by shortages. From late 1939 to early 1947 it was unable to effect renewals and extensions of any consequence because of war-time limitations of expansion and almost complete unavailability of plant and equipment. By 1947 machinery and equipment began to arrive from the United Kingdom, and by 1948 from the Continent, Germany in particular. U.S.A.-made machinery and equipment, which is in widespread and popular use in Australia, has, however, been unavailable—other than to limited degree since the close of the war because of dollar shortages. The supply of machinery and equipment from the U.K., and

to lesser extent from the Continent, has begun to fall away again because of rearmament commitments, and has been further diminished by imports controls (see Appendix II). The industry took full advantage of the 1947-1951 opportunity to take in new plant, and gave particular emphasis to automatic presses. Only a limited range of plant, in small quantity, is made in Australia.

The **OFFSET-LITHOGRAPHY** activity expanded with good early post-war availability from the United Kingdom of one and two-colour sheet-fed presses, and showed the greatest development of any section of the industry in Australia. However, the offset-lithography activity is the only section of the industry that has had the unusual postwar experience of competition from abroad, some large Australian orders for multi-colour labels being placed in the U.K.; the large printing run involved makes such long-distance printing economic, while shortage of paper and of plate-making capacity in Australia at the time probably helped. Bi-metallic and tri-metallic printing plates for long-run work are not yet in commercial use in Australia other than at one daily newspaper (see below), but a few offset-lithographic printers are reported to be experimenting with bi-metallic plates, mainly of a copper printing surface on stainless-steel backing.

The **LETTERPRESS** activity has equipped itself with more high-speed, one and two-colour presses, and perfector presses (perfector presses print on both sides of a sheet in the one pass of a sheet through the press), of the sheet-fed flatbed/cylinder type, but as yet has not entered into the even higher-speed sheet-fed, rotary letterpress work; nor, other than in isolated instances, does it undertake pre-makeready of type-formes in the manner now making significant headway overseas and a necessary prerequisite for sheet-fed rotary letterpress press-work.

Australia has a well stabilised and mature press, with sixteen daily **NEWSPAPERS** in capital cities, thirty-five daily newspapers in provincial cities, and newspapers printed and published at most suburban and country cities and towns at least once a week and in some instances as frequently as five times a week. Despite shortages of newsprint, the Australian press has provided a full and effective news coverage. Recently there has been considerable interest in the use of colour in daily newspapers, although colour printing in supplements and magazine sections has been in use for many years. One newspaper company recently installed a full-colour offset-lithographic press (using bi-metallic printing plates—copper printing surface on stainless-steel backing) in line with letterpress units, and has used that colour for illustrations in daily black letterpress issues. One other newspaper (published at the same period and in the same capital city as the former newspaper using colour "in line") has recently installed full-colour letterpress units in line with black letterpress units and has used that colour for illustrations in daily letterpress issues. A few other daily newspapers can produce in colour, but not at the speed necessary for daily editions.

GRAVURE PRINTING has by far its greatest use in Australia in full-colour rotogravure printing of three women's weekly journals of national circulation, printed and published by daily-newspaper companies, and its use for this and for a few other journals of national

circulation has been very successful. The considerable advantages of gravure for printing on films, foils and hard-surfaced papers, particularly for multi-coloured food-packaging printing, has been appreciated by two leading companies in that field which have installed high-speed multi-colour rotary gravure presses. The use of gravure for work in the field of general printing is inconspicuous to date: one considerable printer of labels by offset-lithography uses gravure as a preferred method for printing of metallic inks on very hard-surfaced papers such as flint papers.

SILK-SCREEN PRINTING of posters, display cards, and other work of short-run nature in direct competition to letterpress and offset-lithography has extended substantially since the close of the 1939-45 War, an expansion considerably helped by screen-printing machines of various types now available. In overall capacity, the screen-printing process is relatively minor as yet in effect on the printing industry (other than in work for which the process is better fitted than the older processes), but will undoubtedly expand further.

The printing industry has become well established in **SPECIALTY PRINTING**, such as greeting cards of wide variety, playing cards, transfers (decalcomania), etc. A machine was installed recently for fast and economic production of colour cards for paint sales, etc. A printed product not made in Australia, however, is **WALLPAPER**, imports of which in 1949-50 and 1950-51 were 117,564 dozen rolls valued at £151,323 and 161,303 dozen rolls valued at 178,909.

The value of imports of printed matter in 1948-49 and 1949-50 was as shown in the table below. (Books, music and magazines are, of course, available chiefly from overseas, and would not have been produced in Australia.)

IMPORTS:	1949-50	1950-51
Calendars and almanacs, advertising and otherwise ...	£12,897	£16,165
Catalogues and price lists ...	24,816	30,845
Paper (printed wrappers) ...	10,034	10,348
Pictures, n.e.i., used or intended to be used for advertising purposes (including photographs)	7,215	15,983
Posters, display signs and show cards for advertising purposes	35,115	50,654
Printed advertising matter, prospectuses, printed tickets (railway, tramway, etc.) ...	122,368	153,491
Labels (paper) of all kinds, printed or not printed, advertising or otherwise ...	18,000	24,983
Pictures for box tops, pad covers, calendars, almanacs, and the like ...	1,862	3,692
Christmas, New Year, Easter and Birthday cards; other greeting cards, having pictorial designs thereon; post cards, n.e.i. ...	108,340	140,963
Playing cards, in sheet or cut ...	31,165	32,185
Transfers—		
Ceramic ...	1,310	461
Other ...	7,626	6,093
Printed matter, non-advertising, n.e.i. ...	52,006	133,947
Fashion books and plates ...	3,050	2,722
Books, n.e.i., music, magazines and periodicals, newspapers ...	2,851,417	3,230,155
Maps, atlases, charts ...	22,027	23,038

Exports of printed matter in 1949-50 and 1950-51 were principally of "books (printed), n.e.i., music, magazines and periodicals, newspapers", valued at £474,988 and £570,629. Of the 1950-51 figure £10,412 represents imported goods.

Trade Services

The trade services of process-engraving, and stereotyping and electrotyping, supply by far the greater part of such engravings, stereo

plates, etc., used by the printing industry as a whole. The almost full dependence by an industry upon those trade services does not apply, however, to trade typesetting and trade binding: many printers and practically all large establishments do much, or all, of their own typesetting and binding, etc.

For most small establishments, the trade typesetters are indispensable, particularly for body (or solid) typesetting. There appears to be a tendency, however, for the trade typesetters to be used to greater extent by the industry generally as there has been a steady, if slow, development in provision of make-up services as well as solid setting and display setting. Reproduction proofs for offset-lithography and gravure work have become an important service by trade typesetters.

Most trade binders are extending their capacity and services, and have encouraged, where good service is given, the "giving-out"

of work such as big runs in stapling and cutting of booklets, which the printer with a bindery usually does internally.

A trade service which was in difficulties meeting a greatly-increased demand in post-war years was that of offset-lithography platemaking. All large lithographers make their own plates, but with the rise of smaller lithographers, including many who are primarily letterpress printers, a much greater demand was made upon the few platemakers providing a trade service. This service had improved considerably by mid-1952, and appears to be well placed now to cope with the demand for all except high-grade plates for multi-colour printing; shortage of skilled labour is mainly responsible for that difficulty. The delays in supply of plates encouraged some lithographers to install platemaking plant (which they might otherwise not have done) and this has reduced the demand on the trade platemakers.

SIGNWRITING

As well as the service of signwriting—on motor vehicles, buildings, shop windows, etc.—many establishments engaged in this industry also produce such items as neon signs (see Chapter 11, "Electrical and Electronic Products"), display signs, screen printing of posters, etc. No statistics are available of produc-

tion by this industry. Adequate facilities and capacity are, however, available to meet requirements. Imports of advertising matter such as posters, display signs and show cards in 1949-50 were valued at £35,115 and in 1950-51 at £50,654.

PHOTOGRAPHIC MATERIAL, AND DEVELOPING AND PRINTING

The manufacture of photographic material is a substantial industry in Australia. Value of output of such materials in 1949-50 was about £2.4 million (including the value of developing and printing). Amongst the more important items made by this industry are sensitised paper, X-ray films, prepared chemicals, films for still and moving cameras, etc. There are, however, substantial imports of some types of photographic materials, including materials used for manufacture. Imports for 1949-50 and 1950-51 were—

IMPORTS:	1949-50	1950-51
Cinematograph films, sensitised, unexposed)—	lin.ft.	lin.ft.
Sub-standard (less than 35 mm. in width)	19,780,559	13,274,789
Standard	57,332,333	37,071,287
Photographic and X-ray dry plates and flat films, sensitised	sq. ft.	sq. ft.
	246,436	653,666
Sensitised films, n.e.i.	868,757	302,315

Sensitised papers, viz.:		
Albumen, auto-type, bromoil, collodion of all types, direct-positive, platinotype and stripping	155,613	185,681
Sensitised blueprint and heliographic papers and fabrics	27,079	39,420
Sensitised paper and cards, n.e.i.; post cards, sensitised	3,217,383	3,186,471
Linen and other materials, n.e.i., sensitised	1,485,289	54,343
Paper specially prepared for coating with photographic emulsions	cwt. 8,790	cwt. 10,228
Board specially prepared for coating with photographic emulsions	2,534	3,859

Those requiring the services of photographic developing and printing, and of blueprinting and dyeline printing, are well catered for in all substantial cities in Australia. Most large engineering establishments operate their own blueprinting or dyeline machines. Fully adequate trade services are available to smaller users.

Part Three: Basic Statistics

COMPARATIVE STATISTICS, 1938-39/1949-50

NUMBER OF ESTABLISHMENTS AT 1938-39 AND 1949-50

NUMBER OF EMPLOYEES AT 1938-39, 1949-50, JUNE 1950, SEPTEMBER 1951

Activity (Statistical Sub-classes used by Commonwealth Statistician, 1949-50)	Establishments		Employees			
	1938-39	1949-50	1938-39	1949-50	June 1950 (a)	Sept. 1951 (a)
	no.	no.	no.	no.	no.	no.
Manufactured Stationery (b)	82	130	2,880	4,376	4,014	4,138
Cardboard Boxes, Cartons and Containers (c)	76	108	3,693	4,455	4,013	5,038
Paper Bags	33	46	777	1,029	1,040	1,003
Other (of Class XII) (d)	37	57	522	796	769	794
Printing—Government	14	16	2,685	2,999	3,013	3,029
Newspapers and Periodicals (e)	472	424	10,091	12,723	12,773	12,388
Printing—General (including Bookbinding) (f)	1,014	1,076	15,684	18,491	17,450	18,087
Stereotyping and Electrotyping	20	25	191	336	} (h) 1,336	} (h) 1,363
Process and Photo Engraving (g)	59	67	1,381	1,331		
Photographic Material (including Developing and Printing) (j)	(k)	78	(k)	2,360	2,210	1,964
Totals (l)	1,807	2,027	37,904	48,896	47,227	47,804

STATISTICAL SUMMARY, 1949-50

EMPLOYMENT, MALE AND FEMALE

SALARIES AND WAGES PAID, IN TOTAL AND PER PERSON ENGAGED

VALUE OF PRODUCTION

VALUE OF MATERIALS, POWER, FUEL, REPAIRS, etc.

VALUE OF OUTPUT

See Explanations, Appendix IV

Activity (Statistical Sub-classes used by Commonwealth Statistician, 1949-50)	Employment			Salaries and Wages Paid		Value of Production	Value of Materials, Fuel, etc. Used	Value of Output
	Males	Females	Persons	Total	Per Person Engaged			
	no.	no.	no.	£'000	£	£'000	£'000	£'000
Manufactured Stationery (b)	2,185	2,191	4,376	1,649	377	3,517	4,620	8,137
Cardboard Boxes, Cartons and Containers (c)	2,297	2,158	4,455	1,673	376	3,426	4,900	8,326
Paper Bags	416	613	1,029	358	348	717	1,767	2,484
Other (of Class XII) (d)	563	233	796	329	413	699	853	1,552
Printing—Government	2,203	796	2,999	1,384	461	1,695	1,133	2,828
Newspapers and Periodicals (e)	11,028	1,695	12,723	6,259	492	11,602	12,169	23,771
Printing—General (including Bookbinding) (f)	12,824	5,667	18,491	7,526	407	13,183	10,082	23,265
Stereotyping and Electrotyping	304	32	336	165	491	318	95	413
Process and Photo Engraving (g)	1,220	111	1,331	687	516	1,081	234	1,315
Photographic Material (including Developing and Printing) (j)	1,136	1,224	2,360	916	388	1,204	1,406	2,610
Totals (l)	34,176	14,720	48,896	20,946	428	37,442	37,259	74,701

Explanatory Footnotes to Both Tables

- (a) These employment figures are taken from monthly payroll-tax returns and differ slightly from the other employment figures, which are supplied on annual factory returns.
- (b) Also includes, where carried on as the sole or major activity or in association with stationery manufacture, the manufacture of printed stationery, docket books, cheque books, invoices and statements in continuous form, index systems, printed and plain, price tickets, printed and plain, tags, greeting cards, playing cards, games; also paper converting, such as manufacture of toilet paper in rolls and sheets, towelling in rolls and interleaved sheets, packeted cigarette papers, cigarette tubes, gummed paper, printed and plain waxed-paper wraps, drinking straws, patty pans, serviettes, creped decorative paper, paper novelties.
- (c) Also includes moulded-pulp containers and wraps; and the manufacture of corrugated container-board and solid-fibre container-board (not including the making of liner, corrugating paper, filler-board and similar materials used in container-board manufacture).
- (d) The sub-class "Other" is one of miscellaneous activities within the Commonwealth Statistician's Class XII, "Paper, Stationery, Printing, Bookbinding, etc.". The sub-class includes the manufacture of pasteboards; art printing paper; gummed printing paper; varnishing of printed work; end-gumming of printed work; sensitising of paper (for blueprinting, dyeline, etc.); cutting of paper (as trade serments; gold blocking; and rubber-stamp manufacture).
- (e) Includes the establishments primarily concerned with printing newspapers and/or periodicals, including those which also carry out general job printing; but where job printing is carried on as a sizable activity

as well as newspaper production and is separately accounted for in essential details, the job printing is usually statistically listed as a general printing establishment separate from the newspaper section.

- (f) Also includes all establishments engaged wholly or mainly in trade typesetting; trade paper-ruling; trade bookbinding; and blueprinting and dyeline printing establishments.
- (g) Also includes offset-lithographic platemaking.
- (h) Separate figures for each sub-class were not published.
- (j) Includes cameras, parts and accessories (excluding lenses), sensitising of film and paper, and developing and printing. The manufacture of cameras, parts and accessories is not statistically separated from the manufacture of materials and post-exposure processing other than for limited production statistics of equipment, apparatus, etc. The activity of camera, equipment, etc., manufacture is dealt with in this study in Chapter 12, "Machinery, Plant, Equipment, Apparatus, Not Elsewhere Included". The activity of materials preparation and post-exposure processing, which constitutes the greater part of the above sub-class, is dealt with in this chapter, "Paper Products, Printing, Signwriting, Photographic Materials."
- (k) At 1938-39 the present sub-classes "Photographic Material (including Developing and Printing)", "Optical Instruments and Appliances" and "Surgical and Other Scientific Instruments and Appliances" (all of the Commonwealth Statistician's Class XV, "Miscellaneous Products") made up one sub-class entitled "Surgical, Optical and Other Scientific Instruments"—see Part Three, Chapter 12.
- (l) Consideration and comparison of totals must take into account the effects stated in footnotes explaining the composition of certain sub-classes and figure units.

Chapter 6 :

**CHEMICAL AND ASSOCIATED
INDUSTRIES**

Part One: Structure of Established Manufacturing Activities

IN setting out the structure of the chemical and associated industries in Australia it has been found desirable to name the four largest companies in the field of chemical manufacture in this country and to provide a prefatory statement of their manufacturing activities. For convenience of reference a fifth company has also been identified in this manner. The list of products given in this structure is not exhaustive, the intention being to refer only to major manufacturing activities.

(It is opportune to mention here that the Division of Industrial Development published in 1950 the second edition of a "Directory of Australian Chemicals", and reference to this will afford clarification of the structure of the industry in terms of the names of manufacturers of all chemicals known to be made in this country.)

FIVE COMPANIES—THEIR ESTABLISHMENTS AND PRODUCTS

Imperial Chemical Industries of Australia & New Zealand Ltd. (referred to subsequently as ICIANZ): The largest chemical-making company in Australia. The company is an associate company of the dominant chemical-making company, Imperial Chemical Industries Ltd., in the United Kingdom, and is associated (by shareholdings), with several leading companies in Australia. A company producing chemicals is operated in conjunction with The Broken Hill Pty. Co. Ltd., using by-products of coke-ovens at the iron and steel works; phosphates, etc., are produced by an associate company; and chemical fertilisers are produced by several associate companies. Associated non-chemical companies are the leading producers of aircraft and aircraft engines in Australia; the leading producer of non-ferrous metal finished shapes and of certain types of power and communication wires and cables; and a leading group of manufacturers of oil and water paints, lacquers and enamels, kalsomine, etc. (The leading ferrous and non-ferrous metal companies have large shareholdings in ICIANZ—see Chapter 9.) ICIANZ, together with subsidiary and associate companies in the chemical industry proper, operates the following establishments—

Alkali works in South Australia, using Solvay ammonia-soda process (duplication of plant now nearing completion): Soda ash, bicarbonate of soda, caustic soda, calcium chloride; limestone and common salt.

Factory in Victoria: Chlorine and caustic soda (by electrolysis), hydrochloric acid, sodium hypochlorite, potassium and sodium chlorates, zinc chloride, aniline, diphenylamine, D.D.T., benzene hexachloride, chlorate and selective weedkillers and fungicidal seed dressings.

Factory in New South Wales: Chlorine and caustic soda (by electrolysis), compressed hydrogen, hydrochloric acid, sodium hypochlorite, zinc chloride, sodium sulphide, carbon bisulphide, carbon tetrachloride, trichlorethylene, perchlorethylene, rubber chemicals, diphenylamine, phenothiazine, polyvinyl chloride, formaldehyde, benzene hexachloride and hormone weedkillers.

Factory in Victoria: Phosphorus, phosphoric acid, food phosphates and other soluble phosphates.

Synthetic-ammonia factory in Victoria: Ammonia, nitric acid, ammonium nitrate, lead nitrate, methanol and formaldehyde.

Four other synthetic-ammonia factories (two in Victoria and two in New South Wales) operated on behalf of the Commonwealth Government: The four factories produce ammonia, ammonium sulphate and nitric acid; three of them can produce methanol.

Leathercloth factory in Victoria: Nitrocellulose (explosive and lacquer grades), nitrobenzene, urea-formaldehyde resins and moulding powders; coating of fabrics with nitro-cellulose, polyvinyl-chloride and rubber; polyvinyl-chloride unsupported film.

Three factory groups in Victoria: Nitroglycerine and blackpowder-type commercial blasting explosives; plain and electric detonators, safety fuse; sporting ammunition; slide fasteners.

Factory in New South Wales: Ammonium chloride, hydrochloric acid, sodium sulphate, phthalic anhydride, beta-naphthol.

Monsanto Chemicals (Aust.) Ltd. (referred to subsequently as Monsanto): Largely owned by two parent companies—one in U.K., the other in U.S.A. One factory in Victoria. Two principal categories of manufacturing activity—one directed to the production of phenolic resins and moulding powders, the other to the production of drugs: Synthetic phenol, formaldehyde, phenol-formaldehyde resins and moulding powders, dimethyl phthalate, salicylic acid, aspirin, salicylanilide, sulpha drugs, selective weedicides, methyl salicylate. Chloramphenicol in conjunction with Parke, Davis & Co. Ltd. Projected manufacture of polystyrene (from imported monomer).

One factory in Queensland: Adhesives for the plywood industry, based on soya bean and casein, together with synthetics, mainly phenolics and ureas.

Colonial Sugar Refining Co. Ltd. (referred to subsequently as CSR): The largest sugar-refining company in Australia, operating two subsidiary companies in New South Wales, using molasses and alcohol derived therefrom as raw materials: Ethanol, carbon dioxide (both liquid and solid), acetic acid, acetone, butanol, butyl acetate, ethyl acetate; also certain fine chemicals including sorbitol and ascorbic acid. Plant in process of erection for projected manufacture of cellulose acetate (for manufacture of rayon by another company) and cellulose-acetate moulding powder.

Timbrol Ltd. (referred to subsequently as Timbrol): An Australian-owned chemical-making company, specializing in coal-tar distillation products and derivatives. One factory, in New South Wales: Tar oils, cresols, xylenols, solvent naphtha, xylenes, phenol, naphthalene, pyridine, coumarone-indene resins, chlorinated coal-tar chemicals, synthetic phenol, nitrobenzene and aniline, xanthates, selective weedicides. New electrolytic plant: Chlorine and caustic soda.

Elliotts & Australian Drug Pty. Ltd. (referred to subsequently as Elliotts): In New South Wales, producing industrial and other chemicals and pharmaceuticals. The company is a member of a drug-house association embracing companies in all States of the Commonwealth. An associate company (Beetle-Elliott Ltd., in which a prominent U.K. company making plastics has an interest) produces phenolic, urea and melamine resins and moulding powders.

PRODUCTS AND MANUFACTURERS

INDUSTRIAL CHEMICALS, GASES; CHEMICAL FERTILISERS; EXPLOSIVES (including Fireworks); **PHARMACEUTICAL CHEMICALS** (including Vaccines, Drugs, Botanical Derivatives, etc., but not compounds); **CHEMICAL COMPOUNDS** (including Weedicides, Insecticides, but not Pharmaceutical and Toilet Preparations): In 1949-50 there were 250, and in 1948-49 there were 242, establishments wholly or mainly engaged in manufacture of one or more products included in the foregoing categories. Of the 242 establishments in 1948-49, 118 each employed up to 10 persons, 32 each from 11 to 20 persons, 43 each from 21 to 50 persons, 11 each from 51 to 100 persons, and 38 each more than 100 persons; the latter 38 establishments collectively employed 9,546 persons out of the industry total of 13,040 persons.

The manufacture of chemical fertilisers, including the making of sulphuric acid and ammonium sulphate integrated with it, is the only activity within the above group that is specifically separated in official statistics. In 1949-50 there were 51, and in 1948-49 there were 50, establishments wholly or mainly engaged in the making of chemical fertilisers. Of these latter establishments, 19 each employed up to 10 persons, 4 each from 11 to 20 persons, 6 each from 21 to 50 persons, 5 each from 51 to 100 persons, and 16 each more than 100 persons; the latter 16 establishments collectively employed 3,123 persons out of an activity total of 3,902 persons.

Sulphuric Acid and Superphosphate: Production mainly associated in all States. Ten companies make both the acid and the fertiliser.

SULPHURIC ACID: Thirteen firms operate twenty establishments, many of which have two or more acid plants.

SUPERPHOSPHATE: Ten firms operate twenty establishments. Only two of the ten firms are independent organisations. The other eight companies operating fourteen establishments are closely associated, by means of shareholdings, either directly with each other or indirectly through a powerful group of mining and chemical companies.

Ammonia and Ammonium Sulphate

AMMONIA: (1) Coal by-product in steel and gas works. (2) Synthetic production from five plants, one being owned by ICIANZ, the other four being operated by that company on behalf of the Commonwealth Government.

AMMONIUM SULPHATE: (1) Steel and gas works. (2) Four Government synthetic-ammonia plants. (3) Projected: Plant is being installed in Tasmania for production of ammonium sulphate by Electrolytic Zinc Co. of Australasia Ltd., the only producer of zinc in Australia.

Alkalis and Chlorine

CAUSTIC SODA AND CHLORINE (electrolytic process): (1) ICIANZ operates electrolytic plants in Victoria and New South Wales. (2) Timbrol, in New South Wales, has recently installed an electrolytic plant. (3) A company making pulp and paper in Tasmania operates an electrolytic plant for its own purpose. The largest paper and paperboard manufacturing company in Australia is installing an electrolytic plant at its chemical-pulp mill, in Victoria; production is expected to begin at early 1953.

SODA ASH, BICARBONATE OF SODA, CAUSTIC SODA (Solvay ammonia-soda process): Only one plant in the Commonwealth, operated in South Australia by a subsidiary of ICIANZ.

Other Inorganic Acids and Chemicals

HYDROCHLORIC ACID (mainly from electrolytic hydrogen and chlorine): Seven companies, which include two superphosphate manufacturers, and ICIANZ and an associate company, and Timbrol.

NITRIC ACID (from oxidation of ammonia and from imported Chilean nitrate): Seven companies, which include three superphosphate manufacturers and ICIANZ, Timbrol and Elliotts.

SODIUM HYPOCHLORITE, POTASSIUM and SODIUM CHLORATES, AMMONIUM CHLORIDE, PHOSPHORUS, PHOSPHORIC ACID, FOOD PHOSPHATES, and other SOLUBLE PHOSPHATES: Solely made by ICIANZ or its subsidiary or associated companies.

CHROMIUM CHEMICALS (sodium and potassium bichromates, sodium chromate, chromic acid, basic chromium sulphate liquor): One company, which specialises in this field.

SULPHUR DIOXIDE, SULPHURYL CHLORIDE, CHLOROSULPHONIC ACID: Solely made by one company, which is also a leading producer of sulphuric acid and superphosphate.

SODIUM SULPHATE: The anhydrous salt is produced by five companies, which include the sole manufacturer of chromium chemicals, and Monsanto and an associate of ICIANZ. Glauber's salt is produced by eight firms, which include one of the foregoing companies and ICIANZ and Elliotts.

SODIUM SULPHITE: Four companies, including Monsanto and Timbrol which produce it from by-product material derived from the manufacture of synthetic phenol.

SODIUM BISULPHITE, SODIUM and POTASSIUM METABISULPHITES: One company, which specialises in these products.

SODIUM SULPHIDE: One company, ICIANZ, which recovers this chemical as a by-product liquor containing up to 40 per cent. sodium sulphide.

SODIUM THIOSULPHATE: Two companies, one of which produces this chemical as a by-product from its manufacture of phenacetin.

COPPER SULPHATE: Four companies, the largest producer being the sole refiner of copper in Australia.

ZINC CHLORIDE: Three companies, which include ICIANZ.

ZINC SULPHATE: Four companies, the sole producer of zinc in Australia, an inorganic chemical and fertiliser manufacturer, and two smaller firms.

HYDROGEN PEROXIDE, SODIUM PERBORATE: One company, which specialises in these products.

MAGNESIUM SULPHATE: Three companies—Elliotts and two others belonging mainly to the pharmaceutical field.

ALUMINIUM SALTS (including alums): One company, which specialises in this field.

BISMUTH SALTS: One company, which specialises in this field.

CADMIUM COMPOUNDS: The manufacture of both salts and pigments is mainly in the hands of one company, which also produces zinc oxide.

Industrial Gases (including Carbon Dioxide)

ACETYLENE, NITROGEN, OXYGEN, HYDROGEN: One controlling company, which operates plants in most States of the Commonwealth. This company is the sole manufacturer of compressed acetylene, oxygen and nitrogen for sale. It is one of the principal producers of hydrogen and in addition markets hydrogen produced in other works. (The company is closely associated with a leading U.K. producer of similar products, and also controls a leading company making electric-welding equipment and electrodes in Australia.)

CARBON DIOXIDE: Produced in solid and liquid forms by (a) CSR as a by-product of fermentation, in New South Wales; (b) four companies (one in New South Wales, one in Victoria, one in Queensland and one in South Australia) which employ the method of burning coke using potassium carbonate as an absorber. The Victorian and South Australian companies are closely associated; the other two companies are subsidiaries of the same parent company. Carbon dioxide is also produced by breweries in various States.

Coal and Coal-Tar Distillation Products and Derivatives

BENZENE, TOLUENE, XYLENES: Mainly from the by-product recovery coke-ovens of the two iron and steel works in New South Wales. Some benzene is also produced by a tar-distilling company in Victoria, and xylenes are also produced by Timbrol.

TAR OILS: Four companies—one a New South Wales gas manufacturer, two small companies using coal-tar from gas works, and Timbrol.

CRESOLS, XYLENOLS: Two companies—a tar distiller in Victoria, and Timbrol.

SOLVENT NAPHTHA: Two iron and steel works in New South Wales, two tar distillers in Victoria, and Timbrol.

PHENOL: Timbrol.

NAPHTHALENE, PYRIDINE: Two companies—an iron and steel works, and Timbrol.

COUMARONE RESINS: Timbrol.

CHLORINATED COAL-TAR CHEMICALS: Timbrol produces the widest range of chemicals in this field, but a few other firms, including ICIANZ, also make various items in this category.

NITROBENZENE, ANILINE: Two companies, ICIANZ and Timbrol, are the principal producers. A company engaged in the production in Western Australia of flavouring and perfume chemicals, produces aniline in the manufacture of vanillin.

MERCAPTOBENZTHIAZOLE, MERCAPTOBENZTHIAZOLE DISULPHIDE, PHENYL-BETA-NAPHTHYLAMINE: ICIANZ.

BETA-NAPHTHOL, PHTHALIC ANHYDRIDE: Associate company of ICIANZ.

Basic, Heavy and Other Organic Chemicals

SYNTHETIC PHENOL: Two companies—Monsanto and Timbrol.

CALCIUM CARBIDE, ACETYLENE BLACK: One company, in Tasmania, whose activities are confined to the production of carbide with the exception that it also makes acetylene black on behalf of another company manufacturing dry batteries in Victoria. Plant capacity for carbide is currently being increased.

CARBON BISULPHIDE: ICIANZ only.

XANTHATES: Timbrol only.

CARBON TETRACHLORIDE, PERCHLORETHYLENE, TRICHTHLORETHYLENE: ICIANZ only.

METHANOL: Synthetic, produced by ICIANZ in some of the five synthetic-ammonia plants. Wood alcohol produced at a charcoal-iron works in Western Australia.

ETHANOL: Three principal producers—by far the largest being CSR. A second company specialises in the production of power alcohol. The third company, the smallest significant producer, engages in the production of rum.

ACETIC ACID: Four companies and one State works. The former include CSR and Monsanto, a chemical and fertiliser company, and one smaller company. The State charcoal-iron works in Western Australia produces acetic acid from wood distillation.

ACETONE, BUTANOL: CSR only.

BUTYL ACETATE: Two companies—CSR and a company making flavourings and essences.

ETHYLENE, ETHYLENE DICHLORIDE: One company—a leading paint manufacturer—produces small quantities from alcohol.

CHLOROFORM: One company—referred to immediately above.

ETHYLENE OXIDE, ETHYLENE CHLOROHYDRIN: Timbrol only.

ETHYLENE GLYCOL ESTERS: One company.

ETHYL ETHER, ETHYL CHLORIDE: The main producer of both chemicals is a company which has specialised in their manufacture for over thirty years. A second producer of both chemicals is the paint-making company referred to against ethylene. A third manufacturer of ethyl chloride is a company making pharmaceuticals.

METHYL BROMIDE, METHYL CHLORIDE: One company—the main producer of ethyl ether and chloride.

CITRIC ACID, POTASSIUM CITRATE, TARTARIC ACID, CREAM OF TARTAR, ROCHELLE SALT: One company, which specialises in the manufacture of these chemicals.

CRUDE TARTARS: One company, which specialises in production from grape residues in South Australia.

WOOL-WAX DERIVATIVES: Elliotts only.

VEGETABLE TANNIN: One company, in Western Australia.

CHEMICAL AND ASSOCIATED INDUSTRIES

SYNTHETIC TANNINS: Three companies, specialising in the manufacture of certain leather and textile chemicals.

Reagent Chemicals: Three companies, including Elliotts.

Plastic Intermediates: About twelve companies are engaged in the production of resins and/or moulding powders for the manufacture of plastics, surface coatings, or synthetic-resin glues.

PHENOLIC RESINS AND MOULDING POWDERS: Three companies make both resins and moulding powders, the two principal manufacturers being Monsanto and Beetle-Elliott. Two other companies make surface-coating grades of these resins. Monsanto makes a liquid-glue grade.

UREA RESINS AND MOULDING POWDERS: Two companies make both resins and moulding powders—ICIANZ and Beetle-Elliott. Two other companies make surface-coating grades of these resins (the same two companies as under phenolic resins). Three companies make liquid-glue grades—ICIANZ, Monsanto and a third company.

MELAMINE RESINS AND MOULDING POWDERS: Beetle-Elliott only.

POLYVINYL CHLORIDE: ICIANZ only.

CELLULOSE ACETATE: Plant in process of erection by CSR for production of cellulose acetate for rayon manufacture (by another company) and cellulose-acetate moulding powder.

POLYSTYRENE: Projected manufacture by Monsanto, from imported monomer.

ALKYD RESINS: Two companies—the same as are referred to under surface-coating grades of phenolic and urea resins.

COUMARONE-INDENE RESINS: Timbrol only.

CASEIN-FORMALDEHYDE: Three companies.

Explosives (Industrial) and Fireworks

EXPLOSIVES (Industrial): ICIANZ only, through a subsidiary company, operating one large and one small establishment.

(Explosives, allied materials, and filling thereof, for Armed Services requirements are almost entirely carried on in Australia within establishments owned and operated by the Commonwealth Government specifically for that purpose.)

FIREWORKS: About five manufacturers, all with small establishments.

Insecticides, Fungicides, Weedicides, Pesticides

INSECTICIDAL SPRAYS AND POWDERS: About eight major manufacturers, whose brands have been long established with the public; about twice that number of manufacturers of intermediate size; and a considerable number of smaller firms. Most of these manufacturers are engaged in divers other activities.

PYRETHRUM EXTRACTS: Pyrethrum flowers are imported and processed mainly by the major manufacturers of insect sprays and powders for their own use, but a few companies produce concentrated extract for sale.

D.D.T.: Two manufacturers—ICIANZ and a leading paint-making company.

BENZENE HEXACHLORIDE: ICIANZ.

ARSENICALS (made from imported arsenious oxide): About eleven companies, seven of which make sodium arsenite, five lead arsenate, two calcium arsenate and one arsenic pentoxide and sulphide, this last firm being the only one which makes all the foregoing arsenicals.

SELECTIVE WEEDICIDES: Five companies, including ICIANZ, Monsanto and Timbrol.

PENTACHLOROPHENOL: Timbrol.

CHLOROPICRIN: One company.

SALICYLANILIDE: Monsanto.

D.D.M.: Timbrol and Elliotts.

Essential Oils, Flavouring and Perfumery Chemicals: An inter-related field of activity with three or four companies outstanding in all categories of manufacture—

EUCALYPTUS OIL AND DERIVATIVES (phellandrene, cineol, citronellol; menthol and thymol): Ten companies engaged in refining of eucalyptus oil and/or the production of derivatives.

OTHER ESSENTIAL OILS (such as oil of cloves, lavender, lemon, orange, sandalwood (Australian) and several other essential oils with the notable exception of peppermint): Five companies (which include three of the firms referred to in connection with eucalyptus oil) produce various essential oils.

NATURAL ISOLATES and SYNTHETIC AROMATICS: About six companies.

Pharmaceutical Chemicals, Drugs, Vaccines, etc.

SULPHA DRUGS, SALICYLIC ACID, ASPIRIN: Monsanto.

THEOBROMINE, CAFFEINE, PHENACETIN: One company makes the three drugs, in South Australia. A second company makes caffeine, in New South Wales.

ATROPINE ALKALOIDS: One company, in Victoria, using native species of the shrub *Duboisia* as raw material.

PHENOTHIAZINE: ICIANZ only.

CHLORAMPHENICOL: Monsanto, in conjunction with Parke, Davis & Co. Ltd.

PENICILLIN, STREPTOMYCIN, SERA, VACCINES, ANTI-ALLERGIC EXTRACTS, ANTI-VENENES, INSULIN: Commonwealth Serum Laboratories—a Commonwealth Government-owned organisation located at Melbourne, Victoria.

VETERINARY BIOLOGICAL PRODUCTS (sera, antitoxins, vaccines): About ten manufacturers, the largest being Commonwealth Serum Laboratories.

PROFLAVINE: Timbrol.

VITAMINS (C and P-P): CSR makes ascorbic acid (C). Timbrol makes nicotinic acid (P-P).

COMPOUNDED PHARMACEUTICAL, VETERINARY, TOILET AND COSMETIC PREPARATIONS (including proprietary medicines and remedies, prescriptive and non-prescriptive preparations, but not the manufacture of basic constituents such as drugs, oils, etc., where manufacture of such is the greater part of the activity of the establishment concerned, or is carried on with the manufacture of other chemicals): In 1949-50 there were 205, and in 1948-49 there were 216, establishments wholly or mainly engaged in compounding of one or more pharmaceutical, veterinary, toilet, cosmetic preparations. Of the 216 establishments in 1948-49, 113 each employed up to 10 persons, 39 each from 11 to 20 persons, 33 each from 21 to 50 persons, 17 each from 51 to 100 persons, and 14 each more than 100 persons; the latter 31 establishments collectively employed 3,308 persons out of the industry total of 5,485 persons.

Pharmaceutical Compoundings: About 70 companies are engaged in the compounding of medicines and remedies, prescriptive and non-prescriptive, in retail packages or in bulk, and proprietary products, mainly for wholesale trading. About twelve large companies are notable in the activity; they are generally described as "wholesale and manufacturing chemists", usually selling many lines, constituent materials as well as compounded products, and other manufacturers' and compounders' products (imported and Australian-made) in addition to their own lines. A few of these companies also make certain of the constituents required in their compounding operations, and normally supply non-manufacturing compounders, pharmacists and dispensaries with such constituents. Three of the manufacturing companies and three compounding/distributing companies are all part of one holding company specifically engaged as a wholesale and manufacturing chemist; this group of companies is the largest of its kind in Australia, and is of Australian origin. Most of the "manufacturing chemists" are concerned only with compounding and wholesaling; one of them is in a co-operative company of a group of retail pharmacists; another is a branch of a similar leading U.S.A. and U.K. business; another, which compounds and sells only its own proprietary lines of family medicines, is a branch of a similar U.S.A. business; some are small, concerned mainly with one or a few proprietary lines. Some of the leading companies also compound toilet preparations including cosmetics, veterinary and household chemical preparations, but to a minor extent relative to their pharmaceutical compounding.

Veterinary Preparations: There is a large market in Australia for veterinary products and this is well catered for by at least 23 companies with 20 or more employees and over 100 firms employing less than 20 persons. The compounding of veterinary preparations has usually developed as a branch from other activities, which include chemical and stock-food manufacture, woolbroking, stock-and-station agencies, and the professional work of veterinary surgeons and pharmacists. A few companies specialise in one product, but most make a range of different products, and at least one company makes over a hundred preparations for farm and domestic animals.

Cosmetics, Toilet Preparations: About 150 manufacturers collectively make a complete range of cosmetic and toilet compounds. About ten companies are prominent as manufacturers/distributors of nationally advertised brands, each usually covering all the main types of cosmetics; these manufacturers mostly have overseas affiliations, and in two instances are branches of overseas cos-

metic companies. About five other manufacturers selling their own brands of cosmetics and toilet preparations, particularly for chain-store selling, also supply in bulk and in retail packages to other wholesalers and manufacturers in the activity. Some of the pharmaceutical compounders, and one of the largest toilet-soap and toothpaste manufacturers in Australia, are also manufacturers of well-advertised brands of toilet preparations and cosmetics. The greater number of manufacturers in the activity are small manufacturers with one or a few specialities.

PAINTS, VARNISHES, LACQUERS, PIGMENTS AND OTHER INGREDIENTS: In 1949-50 there were 149, and in 1948-49 there were 152, establishments wholly or mainly engaged in manufacture of paints, etc., and/or ingredients. Of the 152 establishments in 1948-49, 86 each employed up to 10 persons, 29 each employed from 11 to 20 persons, 19 each from 21 to 50 persons, 8 each from 51 to 100 persons, and 10 each more than 100 persons; the latter 10 establishments collectively employed 2,264 persons out of an industry total of 4,257 persons.

Paints, etc.

PAINTS, VARNISHES, ENAMELS, SYNTHETIC FINISHES, STAINS, LACQUERS, WATER-PAINTS, KALSOMINE: About 140 manufacturers, making one or more of the foregoing products. The major companies, in general, make a complete range of surface-coatings except kalsomine, of which there are four principal producers. Most of the major paint producers are associated with overseas companies.

Pigments and Frits

WHITE LEAD: Three companies, two of which are also major producers of surface coatings.

ZINC OXIDE: Seven companies, one of which is a principal producer of steel wire, wire netting, barbed wire, nails.

TITANIUM PIGMENTS: One manufacturer, associated with ICIANZ.

OTHER PIGMENTS (chrome pigments, iron blues, zinc greens, earth pigments, lake pigments, etc.): About 10 manufacturers.

VITREOUS-ENAMEL FRITS: One principal producer (associated with a subsidiary company engaged in the same activity in the U.S.A.), and three other producers, two of which make only for their own requirements.

Driers

METALLIC SOAPS (mainly stearates of aluminium, calcium, lead, magnesium and zinc): Four manufacturers, including CSR and Elliotts.

NAPHTHENATES (mainly of cobalt, copper, lead, manganese and zinc): Six companies manufacture for sale.

VEGETABLE OILS: In 1949-50 and in 1948-49 there were 25 establishments wholly or mainly engaged in manufacture of vegetable oils. In 1948-49, of these establishments, 12 each employed up to 10 persons, 2 each from 11 to 20 persons, 8 each from 21 to 50 persons, and 3 each from 51 to 100 persons; the latter 11 establishments collectively employed 547 persons out of the industry total of 637 persons. Excluding olive oil (of which there are about three principal producers and sundry others), and excluding cottonseed oil (which is produced in small quantities by the Queensland Cotton Board), there are about 10 companies engaged in the production of vegetable oils discussed here. Of these ten companies, three are mainly or wholly engaged in the production of linseed oil, one in the production of castor, coconut, rapeseed and sunflower-seed oils, one in the production of coconut oil only, and one company produces only tung oil.

LINSEED OIL: Four companies—one has factories in New South Wales, Victoria, Queensland and South Australia, two are established in New South Wales only, and one is located in Western Australia.

TUNG OIL: One company, in New South Wales.

CASTOR, RAPESEED and SUNFLOWER-SEED OIL: One company produces all three oils, in Victoria. One company produces castor and sunflower-seed oil of edible grades, in New South Wales. A company which produces linseed oil, also produces rapeseed oil, in Western Australia.

COCONUT OIL (including hydrogenated), **MAIZE OIL, PEANUT OIL:** Six companies produce coconut oil, two of them being associated, one producing crude oil, the other edible oil. Another produces maize oil in addition. One other firm (a leading manufacturer of glucose) produces maize oil only.

SOAP AND GLYCERINE (including fatty acids, but not synthetic detergents): In 1949-50 there were 90, and in 1948-49 there were 91, establishments wholly or mainly engaged in manufacture of soap and allied products. Of the 91 establishments in 1948-49, 67 (75 per cent. of total establishments) each employed up to 10 persons, 7 each from 11 to 20 persons, 7 each from 21 to 50 persons, 1 from 51 to 100 persons, and 9 each more than 100 persons; the latter 9 establishments collectively employed 2,885 persons out of an industry total of 3,585 persons.

GLYCERINE: Seven companies make glycerine as a by-product of tallow and vegetable-oil processing; six of those companies are soap-makers.

SOAPS (including sandsoap, cleansers, but not synthetic detergents): A full range of soaps and allied cleansers in various end forms is made by the industry for industrial and household needs. The principal producer operates six establishments and is a branch company of an international soap and food combine. Another leading manufacturer is an associate company of a substantial manufacturer of similar products in the U.S.A. Candles are made by a few manufacturers.

OLEIC, STEARIC and OTHER FATTY ACIDS: About six companies, four of which are soap makers, make both oleic and stearic acids. Two other manufacturers make vegetable-oil fatty acids.

SULPHONATED OILS, SULPHONATED FATTY ALCOHOLS: Six companies produce sulphonated oils, and four of those companies also produce sulphonated fatty alcohols. These companies specialise in the production of these materials for supply to the tanning and textile industries.

INKS, ADHESIVES, POLISHES, LAUNDRY BLUE: In 1949-50 there were 127, and in 1948-49 there were 122, establishments wholly or mainly engaged in manufacture of one or more items of the categories of this group. Of the 122 establishments in 1948-49, 89 each employed up to 10 persons, 19 each from 11 to 20 persons, 11 each from 21 to 50 persons, 2 each from 51 to 100 persons, and 1 employed 109 persons; the establishments each employing from 5 to 20 persons collectively employed 605 persons out of the group total of 1,152 persons.

Inks

PRINTING INKS, STENCILLING INKS, PRINTERS' ROLLER COMPOSITION: Twelve manufacturers of printing inks, two of which each have establishments in two States, and five of which distribute in all States. The three principal manufacturers of printing inks are also printers' furnishers (machinery and equipment), and each have overseas technical affiliations. Two recently established factories are each a branch of two prominent U.K. printing-ink manufacturers. Printers' roller composition is mainly made by four of the larger ink manufacturers, who also do most of the roller casting for the printing trade.

WRITING INKS: Eleven manufacturers, of which at least three have overseas affiliations. Three of the companies make only inks intended for fountain-pen use. The larger manufacturers concerned particularly with office inks, school inks, etc., are also usually paste and mucilage manufacturers. Two of the writing-ink makers also make drawing inks, and one makes showcard colours.

Adhesives

MUCILAGES, PASTES: About 20 manufacturers, some of which make both mucilage and paste, some of which make paste and not mucilage. Several are inkmakers, and at least four are makers of industrial adhesives generally, including one of the major glue manufacturers.

INDUSTRIAL ADHESIVES: About 30 manufacturers, including some companies principally engaged in manufacture of rubber products and a company considerably engaged in the combining of fabrics and/or felt. Only a few manufacturers are concerned with industrial adhesives as the sole or major activity.

Polishes: About 90 manufacturers. Boot and shoe polishes are made by about 20 companies, of which two are prominent, one of the two also having established factories overseas in several countries. Domestic polishes, including car polishes, are made in wide variety, some manufacturers being large, many of them small, and most of them specialist in the manufacture of polishes. In addition there are about 20 other companies which make polishes as a minor activity.

Laundry Blue: Two manufacturers, one of them (a branch of a U.K. manufacturer) supplying most of the market. Each company manufactures and wholesales various grocery lines.

MISCELLANEOUS ACTIVITIES that are statistically associated with the chemical and associated industries, but not covered previously in this Part, are listed below, with, where known, the number or an approximation of the number of manufacturers of the products concerned; however, not all manufacturers are wholly or mainly engaged in manufacture of such products. (In official statistics the activities, where carried on as the sole or major activity, are grouped together in a miscellaneous sub-class of statistics. In 1949-50 there were 21 establishments so grouped; in 1948-49, 10 each employed up to 10 persons, 3 each employed from 11 to 20 persons, 5 each from 21 to 50 persons, 1 employed 64 persons, and 2 each employed more than 100 persons, the latter 2 establishments employing 573 persons out of the group total of 907 persons.)

LANOLIN: Mainly produced by one firm, which owns and operates plants for the recovery of wool grease from the scour effluent of three woollen mills, two being located in New South Wales and one in Victoria. Most of the grease recovered from all three establishments is processed at the Victorian plant for the production of lanolin B.P.

GUT: Surgical gut is made by three firms in Australia. There are seven makers of stringing gut, including one that is a subsidiary of the leading rubber-products company in Australia. There is also one manufacturer of gut core for sheep-shearing machines.

DISTILLED WATER: Several distillers; the principal commercial distillers (four of which are specialists in the activity) also engage in distribution of their products in carboys to battery makers and service stations, silverers, pharmaceutical compounders and other industrial users, and in bottles for retail sale by garages, service stations, etc. Some breweries also sell distilled water in bulk. A few companies among the industrial users distil their own requirements. (The Commonwealth Scientific & Industrial Research Organisation has a plant for triple distillation of water for use in scientific research.)

Part Two: Outline of Capacity of Manufacturing Activities

THE Australian chemical industry has achieved its present development partly through a natural growth over a comparatively long period, but in much larger measure through the accelerated responses exacted by the diverse imperatives of the War of 1939-45.

The industry may be said to have originated in 1872 when the manufacture of sulphuric acid and superphosphate was first established. During the long period of slow and intermittent development which followed, the industry became established in several other major fields of activity. In the years immediately preceding 1939, chemical manufacture in Australia had been moving more swiftly towards increasing self-sufficiency, and plans made during this period were to a large extent responsible for the great increases in production and the variety of new manufacture which later took place. The enterprise and intense application called forth by the war produced rapid and

spectacular development. The third phase of expansion has occurred in the postwar period, during which most of the wartime achievements have been carried forward and consolidated, and a considerable amount of new or extended manufacture has been undertaken or planned.

The following account of the chemical and associated industries is presented in two separate sections: the first is designed to show the present extent of these industries in Australia; the second deals with items which are not as yet produced in Australia or are only produced in limited quantity.

EXTENT OF INDUSTRIES

The following is a description of the chemical and associated industries in the major categories of manufacturing activity at present carried on in Australia; it includes brief notes on the existing and projected production of the principal items within each group, the extent to which local demands are being met, together with appropriate references to methods of manufacture and use of raw materials.

The classifications adopted in the presentation are to some extent necessarily arbitrary and are by no means exclusive; the inter-relations of the chemical and associated industries are complex and, although there is a considerable degree of specialisation, many manufacturers are engaged in several fields of activity.

The following is a tabulation of the main groups, sub-groups and principal products covered in the text which follows—

INDUSTRIAL CHEMICALS, GASES; CHEMICAL FERTILISERS; EXPLOSIVES; PHARMACEUTICAL CHEMICALS, CHEMICAL COMPOUNDS (not including Pharmaceuticals, Veterinary and Toilet Preparations)—

Sulphuric Acid, Chemical Fertilisers, Ammonia

Sulphuric acid, superphosphate
Ammonia, ammonium sulphate
Potash fertilisers; sodium nitrate

Alkalis and Chlorine

Caustic soda and chlorine by electrolysis
Alkalis by the Solvay ammonia-soda process

Other Inorganic Acids and Chemicals

Nitric acid
Hydrochloric acid
Sodium hypochlorite
Potassium and sodium chlorates
Ammonium chloride
Zinc chloride
Zinc sulphate
Copper sulphate
Hydrogen peroxide; sodium perborate
Phosphorus, phosphoric acid, food phosphates, soluble phosphates
Chromium chemicals
Sulphur dioxide, sulphuryl chloride, chlorosulphonic acid
Sodium sulphate
Sodium sulphite
Sodium bisulphite, sodium and potassium metabisulphites
Sodium thiosulphate

Sodium sulphide
Magnesium sulphate
Aluminium salts (including alums)
Bismuth salts
Cadmium compounds
Diatomaceous filter aid

Industrial Gases (including Carbon Dioxide)

Acetylene, hydrogen, nitrogen, oxygen, nitrous oxide
Carbon dioxide

Coal and Coal-Tar Distillation Products and Derivatives

Benzene, toluene, xylenes
Other coal-tar primary chemicals
Chlorinated products
Nitrobenzene and aniline; diphenylamine
Rubber accelerators and anti-oxidants: mercaptobenzthiazole, mercaptobenzthiazole disulphide, phenyl-beta-naphthylamine; xanthates
Phthalic anhydride, beta-naphthol; dibutyl and dimethyl phthalates

Basic, Heavy and Other Organic Chemicals

Synthetic phenol
Calcium carbide; acetylene black
Calcium cyanamide, dicyandiamide
Carbon bisulphide; xanthates
Carbon tetrachloride, perchlorethylene, trichlorethylene
Methanol, formaldehyde
Hexamine
Ethanol
Acetic acid
Acetone
Butyl alcohol, butyl acetate
Lactic acid
Ethyl acetate
Ethylene, ethylene chemicals
Ethyl ether, ethyl chloride
Chloroform
Methyl chloride
Citric acid, potassium citrate; cream of tartar, tartaric acid, Rochelle salt
Crude tartars
Lanolin
Wool-wax derivatives
Waxes: beeswax, sugarcane wax
Vegetable and synthetic tannins

Reagent Chemicals

Plastic Intermediates

Phenolic resins and moulding powders
Urea resins and moulding powders
Melamine resins and moulding powders
Polyvinyl chloride
Cellulose acetate
Polystyrene
Synthetic resin glues

Coumarone-indene resins

Alkyd resins

Plasticisers

Casein, rennet and lactic

Explosives (Industrial) and Fireworks

Explosives; detonators; fuse; sporting ammunition

Fireworks

Insecticides, Fungicides, Weedicides, Pesticides

Insecticidal sprays and powders

Pyrethrum extracts; D.D.T.; benzene hexachloride

Nicotine sulphate

Arsenical preparations; arsenious oxide

Non-specific weedkillers

Selective weedicides

Pentachlorophenol

Chloropicrin

Salicylanilide

D.D.M.

Essential Oils, Flavouring and Perfumery Chemicals

Eucalyptus oil and derivatives; other essential oils

Flavouring chemicals

Perfumery chemicals: essential oils, natural isolates, synthetic aromatics

Pharmaceutical Chemicals

Sulpha drugs

Salicylic acid, aspirin

Theobromine, caffeine; phenacetin

Atropine alkaloids

Phenothiazine

Penicillin, streptomycin

Sera and vaccines; anti-allergic extracts; anti-venenes; insulin

Chloramphenicol

Proflavine; amino-acridines

Vitamins

COMPOUNDED PHARMACEUTICALS, PROPRIETARY MEDICINES AND REMEDIES, AND VETERINARY PREPARATIONS

COSMETIC AND TOILET PREPARATIONS

PAINTS, VARNISHES, LACQUERS, PIGMENTS AND OTHER INGREDIENTS

Paints, varnishes, lacquers, enamels, synthetic finishes

Pigments: chemical colours; white lead; titanium dioxide; lead oxides; zinc oxide; iron oxides

Nitro-cellulose

Driers: metallic soaps; naphthenates

Synthetic resins

VEGETABLE OILS

Castor oil, dehydrated, sulphonated

Coconut oil, hydrogenated

Maize oil

Peanut oil

Cottonseed oil

Olive oil

Sunflower-seed oil

Rapeseed oil

Linseed oil

Tung oil

Candlenut oil; soya bean oil; safflower oil

SOAPS, GLYCERINE, FATTY ACIDS, DETERGENTS

Soaps; candles

Glycerine

Stearine, olein; fatty acids

Fatty alcohols

Surface-active preparations: synthetic detergents and wetting agents

INKS, ADHESIVES, POLISHES, LAUNDRY BLUE

Printing inks; printers' roller composition

Writing inks

Mucilage; pastes

Industrial adhesives

Polishes

Laundry blue

INDUSTRIAL CHEMICALS, GASES; CHEMICAL FERTILISERS; EXPLOSIVES; PHARMACEUTICAL CHEMICALS; CHEMICAL COMPOUNDS (not including Pharmaceuticals, Veterinary and Toilet Preparations)

Sulphuric Acid, Chemical Fertilisers, Ammonia

The production of SULPHURIC ACID AND SUPERPHOSPHATE, which was first established in Australia in 1872, had expanded to considerable proportions prior to the 1939-45 War. It is one of the largest chemical manufacturing activities in this country. The production of the acid is almost entirely associated with that of superphosphate. In 1947-48, 91 per cent. of the sulphuric acid produced was used in making chemical fertilisers—83.5 per cent. for superphosphate and 7.5 per cent. for ammonia sulphate.

SULPHURIC ACID is produced in twenty factories in Australia, many of which have two or more acid plants. Some plants are equipped to operate on brimstone only, some on local raw materials only, and the remainder can use either. Most of the installations are chamber plants. In 1947-48, 57 per cent. of production of sulphuric acid was from imported brimstone, the remainder being made from zinc concentrates (18.5 per cent.), pyrite concentrates (22 per cent.) and spent oxide (2.5 per cent.). In view of the world situation in respect of diminishing sulphur supplies and the high dollar cost of brimstone imported from the United States of America, increasing attention is being given in Australia to the utilisation of indigenous sulphur-bearing minerals. An example of this is a new plant which is being installed to use roaster gases from lead concentrates.

Output of sulphuric acid declined during the war owing to abnormal conditions. Post-war production however has greatly increased, as shewn by the following figures expressed in monoton: 470,000 in 1938-39, 580,000 in 1948-49, 612,000 in 1949-50 and 637,000 in 1950-51. Nevertheless, in some States current production is unable to meet local demands in full, there be-

ing little interstate trade. Owing to increasing demands for fertiliser manufacture and other purposes, additional plant is being built and planned in various States. Production in 1952, however, will be seriously reduced because of a shortage of imported sulphur. This will have a corresponding effect on the production of superphosphate.

Production of SUPERPHOSPHATE was 1,199,000 tons in 1938-39, then declined greatly during the war, but recovered in 1945-46 to approximately the pre-war level and has since steadily increased, reaching 1,423,000 tons in 1948-49, 1,483,000 tons in 1949-50 and 1,575,000 tons in 1950-51. Productive capacity is being raised to meet increased future demands. The necessary raw material supplies of rock phosphate are imported from Nauru and various other Pacific Islands.

In the pre-war period, AMMONIA and AMMONIUM SULPHATE were produced in Australia almost entirely as coal by-products in steel and gas works. During the war, four Government SYNTHETIC-AMMONIA plants were established in addition to one previously erected by ICIANZ.

Since 1946, equipment for the manufacture of ammonium sulphate has been installed in the four Government plants, each plant being designed for a maximum production of 12,000 tons per annum of ammonium sulphate. In addition, a £2,500,000 plant is being installed in Tasmania with an initial annual output of 50,000 tons of this fertiliser. Production is expected to commence in 1954.

From a long-term point of view, maximum local production from all these sources should suffice to meet increasing Australian requirements. However, if optimum production is not obtained, it will be necessary, as in the past, to import supplementary quantities.

Production of ammonium sulphate rose from 20,000 tons in 1938-39 to 53,000 tons in 1948-49, 49,000 tons in 1949-50 and 57,000 tons in 1950-51.

In regard to SODIUM NITRATE and POTASH FERTILISERS, Australia is dependent on imports. In recent years there has been some production of a potassium and sodium sulphate mixture from a State Government enterprise at Lake Chandler in Western Australia where there are deposits of alunite, but owing to technical difficulties and uneconomic operation, the works were recently closed down for an indefinite period. Imports of sodium nitrate were 7,173 tons for 1948-49, 13,416 tons for 1949-50 and 5,679 tons for 1950-51. Imports of potash fertilisers were 9,220 tons for 1948-49 and 12,924 tons for 1949-50.

Alkalis and Chlorine

The production of CAUSTIC SODA and CHLORINE BY ELECTROLYSIS of salt was first established in Australia in Victoria in 1919. During the 1939-45 War, ICIANZ increased the output from this plant and established a second electrolytic plant in a new factory in N.S.W., which came into operation in 1944. Timbrol has recently installed an electrolytic plant in N.S.W. The overall supply of chlorine is still inadequate and ICIANZ has announced its intention of expanding plant capacities in both N.S.W. and Victoria.

A pulp and paper manufacturing company in Tasmania operates an electrolytic plant for its own purposes.

Of interest in this connection is a recent announcement by the largest paper and paper-board manufacturing company in the Commonwealth of its intention to establish its own electrolytic plant for the production of caustic soda and chlorine. The company hopes to bring the plant into production within two years, and states that arrangements have already been made for the disposal of caustic soda surplus to its own requirements.

The possibility of establishing a plant for the production of ALKALIS by the SOLVAY AMMONIA-SODA PROCESS, using salt recovered by solar evaporation of sea water, had been investigated prior to the war, and a most important step in the development of the Australian chemical industry was the erection by ICIANZ of a large alkali plant at Osborne, South Australia, which came into operation in 1940, producing CAUSTIC SODA, SODA ASH, BICARBONATE OF SODA and CALCIUM CHLORIDE.

Australia has trebled its consumption of alkalis in the past decade and these essential chemicals have been in seriously short supply in post-war years. In 1946 the duplication of the Osborne works was planned, providing a total productive capacity approaching 100,000 tons a year. The project is now nearing completion and is expected to cost over £2½ million.

Production of caustic soda for 1948-49 totalled 14,114 tons, and 12,202 tons were imported; production for 1949-50 was 11,613 tons, and 3,649 tons were imported. Production figures for soda ash are not available; imports for 1948-49 were 42,127 tons, for 1949-50 9,392 tons and for 1950-51 52,950 tons.

Other Inorganic Acids and Salts

NITRIC ACID is made by the oxidation of ammonia and also from imported Chilean nitrate. Production in 1949-50 totalled 6,361 tons and in 1950-51 7,248 tons. The diversion of syn-

thetic ammonia from the production of ammonia sulphate would afford additional productive capacity if required.

HYDROCHLORIC ACID is mainly made from electrolytic hydrogen and chlorine. In terms of 100 per cent. acid, production increased from 2,737 tons in 1938-39 to 3,425 tons in 1948-49 and 3,580 tons in 1949-50, but supplies are barely adequate.

Ample supplies of SODIUM HYPOCHLORITE are available, production in 1948-49 being 417,681 gallons of 12½ per cent. liquor and in 1949-50 412,732 gallons.

The production of POTASSIUM AND SODIUM CHLORATES was commenced during the war. Output of the first is sufficient for the demand and of the second, nearly so.

Production of AMMONIUM CHLORIDE—largely used for galvanising and in dry batteries—was also begun during the war. Supply from the sole manufacturer is almost adequate, imports for the two years 1947-49 averaging 125 tons a year, and those for 1949-50 being only 14 tons.

Production of ZINC CHLORIDE increased from 278 tons in 1945-46 to 520 tons in 1948-49, but fell to 205 tons in 1949-50. All local production is in the form of a concentrated solution, but there is also a demand for solid zinc chloride which is met by imports, those for 1948-49 being 274 tons, for 1949-50 99 tons and for 1950-51 67 tons.

ZINC SULPHATE is produced in considerable quantities which are sufficient to meet local requirements for agriculture, mining and other purposes.

The manufacture of COPPER SULPHATE has been established for many years and considerable quantities are produced. Plant capacity increased post-war and by 1948-49 was approaching the demand for agricultural and horticultural use and mineral flotation, imports having decreased as follows: 1946-47, 2,005 tons; 1947-48, 518 tons; 1948-49, 226 tons. Local production has since declined owing to the current shortage of copper, and in 1949-50 copper sulphate imports rose to 1,541 tons; imports for 1950-51 were 1,366 tons.

Adequate supplies of HYDROGEN PEROXIDE are produced by the sole Australian manufacturer, whose productive capacity exceeds local requirements. Production of SODIUM PERBORATE by the same firm is limited by the necessity to import American borax.

A major development occurred in 1942-43 with the commencement of production of PHOSPHORUS, PHOSPHORIC ACID, FOOD PHOSPHATES and other SOLUBLE PHOSPHATES for water softening, detergent and degreasing purposes.

Another notable advance was made when the manufacture of sodium bichromate was established in 1944. Australian self-sufficiency in regard to CHROMIUM CHEMICALS has since been almost attained, those now produced by the one manufacturer including potassium bichromate, sodium chromate, chromic acid, and basic chromium sulphate liquor. The necessary raw material supplies of chromium ore are imported, mainly from New Caledonia and South Africa.

The manufacture of liquid SULPHUR DIOXIDE, SULPHURYL CHLORIDE and CHLOROSULPHONIC ACID was first undertaken during the war. This resulted in adequate supplies of sulphur dioxide for refrigera-

tion and of sulphuryl chloride for the textile industry. Chlorosulphonic acid is required for the production of the anti-dysentery drug sulphaguanidine.

SODIUM SULPHATE is produced in adequate quantities as the anhydrous chemical and Glauber's salt. Production of sodium sulphate increased from 1,607 tons in 1938-39 to 8,332 tons in 1948-49; production for 1949-50 was 7,131 tons.

Production of **SODIUM SULPHITE** is adequate to demand, much of it being produced from by-product material from the manufacture of synthetic phenol.

Production by the one existing manufacturer of **SODIUM BISULPHITE** and **SODIUM AND POTASSIUM METABISULPHITES** is handicapped by the high local cost of alkalis, and these chemicals are also imported.

SODIUM THIOSULPHATE is produced by two firms, in one instance as a by-product of the phenetidine stage in the manufacture of phenacetin. Output is insufficient for the demand. Imports for 1948-49 were 467 tons valued at £16,135, and in 1949-50 were 283 tons valued at £8,284.

SODIUM SULPHIDE is produced in Australia only by ICIANZ, as a by-product liquor containing up to 40 per cent. sodium sulphide. Supplies are inadequate and substantial imports are necessary, as shown by the quantities brought in during recent years, as follows: 1946-47, 1,318 tons, £33,065; 1947-48, 2,920 tons, £112,161; 1948-49, 1,284 tons, £53,436; 1949-50, 1,222 tons, £36,112.

MAGNESIUM SULPHATE is produced in quantities which are almost sufficient to meet local consumption, comparatively little being imported. One of four producers in 1949 found its manufacture unprofitable and discontinued production.

ALUMINIUM SALTS (including **ALUMS**) are produced in adequate quantities by the sole manufacturer. Local deposits of bauxite are used for raw material.

BISMUTH SALTS are made in a wide range by one manufacturer. Local requirements appear to be largely satisfied, imports being small.

CADMIUM SALTS are produced in sufficient quantity to satisfy requirements for electroplating and certain other purposes. Imports are not significant. Cadmium pigments are made in Australia and are also imported.

The production of **DIATOMACEOUS FILTER AID** was begun during the war. Large quantities of this material are consumed in Australia. The market was previously supplied from the United States of America, and some high-grade material is still imported.

Industrial Gases (including Carbon Dioxide)

The manufacture in Australia of compressed **ACETYLENE**, **OXYGEN** and **NITROGEN** for sale is solely in the hands of one controlling company which operates plants in most States of the Commonwealth. This company is one of the principal producers of **HYDROGEN** and markets hydrogen produced in other works. **NITROUS OXIDE** is also made by this company. Production of all these gases is adequate for present requirements. Argon and other rare gases are not produced in Australia.

CARBON DIOXIDE in both solid and gaseous forms is produced as a by-product from fermentation and also by the burning of coke (using potassium carbonate as an absorber), in

four works devoted to the purpose. Supplies are ample for all requirements. Production for 1948-49 was 4,918 tons of solid carbon dioxide and 4,568 tons of gas; production for 1949-50 was 4,714 tons of solid and 6,106 tons of gas.

Coal and Coal-Tar Distillation Products and Derivatives

BENZENE, **TOLUENE** and **XYLENES** are produced in Australia from the by-product recovery coke-ovens of the iron and steelworks. To a smaller extent benzene and xylenes are also produced by the treatment of coal tar from gasworks.

The chemical uses of benzene have greatly increased since the war, and production has been affected by coal shortages. Nevertheless, all industrial requirements are being met and about one million gallons a year are blended with petrol for fuel.

Other coal-tar primary chemicals produced in Australia include **CREOSOTE**, **CRESOLS**, **XYLENOLS**, **SOLVENT NAPHTHA**, **PHENOL**, **NAPHTHALENE**, **PYRIDINE**, **COUMARONE** and **COUMARONE-INDENE RESINS**.

The treatment of coal-tar chemicals was considerably extended during the war, and a feature of post-war development in this field has been the manufacture of a number of **CHLORINATED PRODUCTS**.

The manufacture of **NITROBENZENE** and **ANILINE** was undertaken by ICIANZ and Timbrol during the war, and production has been continued. ICIANZ also produces **DIPHENYLAMINE**.

During the later part of the war, ICIANZ commenced production of the widely-used rubber accelerator **MERCAPTOBENZTHIAZOLE** and the rubber anti-oxidant **PHENYL-BETA-NAPHTHYLAMINE**, both of which require aniline for their manufacture. **MERCAPTOBENZTHIAZOLE DISULPHIDE** is also made.

RUBBER ACCELERATORS and **ANTI-OXIDANTS** of the xanthate type are produced in Australia. Imports for 1948-49 of rubber accelerators and anti-oxidants other than xanthates were 288 tons valued at £90,025, and in 1949-50 were 448 tons valued at £93,047.

In 1942 a plant came into operation for the production of **BETA-NAPHTHOL** and **PHTHALIC ANHYDRIDE** from naphthalene. Local supplies of phthalic anhydride have assisted Australian manufacturers of alkyd resins for surface coatings, and this chemical is also used in Australia for the production of **DIBUTYL** and **DIMETHYL PHTHALATES**, which are used as plasticisers and which have continued in their war-time applications as insect repellents for protection against malaria and scrub-typhus. Local production of phthalic anhydride, however, falls far short of demand, 140 tons valued at £33,473 having been imported in 1948-49, 543 tons valued at £90,697 in 1949-50 and 1,358 tons valued at £260,477 in 1950-51. Beta-naphthol is locally used in the purification of zinc and also for the manufacture of the rubber anti-oxidant phenyl-beta-naphthylamine.

Basic, Heavy and Other Organic Chemicals

An important development in the basic organic chemical industry in Australia was the establishment by Monsanto and Timbrol during the war of two plants for the production of **SYNTHETIC PHENOL** from benzene. This has resulted in adequate supplies of phenol for the local manufacture of phenolic resins and moulding powders.

CALCIUM CARBIDE is produced in Australia at only one plant, which is situated at Electra, Tasmania, where the necessary supply of cheap hydro-electric power is available. The present capacity of this plant is insufficient to meet local requirements and supplementary quantities of carbide are imported, 4,327 tons valued at £139,367 in 1948-49, 1,009 tons valued at £26,610 in 1949-50, and 2,232 tons valued at £63,472 in 1950-51.

Steps are at present being taken to increase the capacity of this plant. Hitherto, most of the carbide produced has been directed to the production of acetylene for use as fuel, a proportion being used from 1946 onwards for making acetylene black (mainly used in the manufacture of dry batteries). However, the recent commencement of manufacture of polyvinyl chloride in Australia has added substantially to the demand, and since the production of this plastic is expected to increase considerably during the next few years the present level of demand will rise still further.

There is a further aspect of carbide production in Australia, that of utilising acetylene for the manufacture of various chemicals, some of which are at present produced from alcohol or other raw materials. It has been estimated that carbide could be made at Electra on a greatly increased scale at a sufficiently low price for a chemical industry based on acetylene to be established in Australia.

The manufacture of **CALCIUM CYANAMIDE** and **DICYANDIAMIDE** was started by Timbrol during the war and developed for the manufacture of the anti-dysentery drug sulphaguanidine. Production of both these chemicals has now been discontinued owing to the high cost of carbide and the limited market for dicyandiamide.

CARBON BISULPHIDE has been produced in Australia by one firm, **ICIENZ**, for many years. It is used by **ICIENZ** for the production of carbon tetrachloride. In addition to its application as a fumigant and solvent, it is used by Timbrol for the manufacture of **XANTHATES** for mineral ore flotation and other purposes. Present supplies of carbon bisulphide are adequate, but when plans for the manufacture of viscose rayon in Australia are fulfilled, increased quantities will be needed and **ICIENZ** is already taking steps to meet this future additional demand.

An important development occurred in 1945 with the commencement of production by **ICIENZ** in New South Wales of chlorinated hydrocarbons, namely **CARBON TETRACHLORIDE**, **PERCHLORETHYLENE** and **TRICHOLORETHYLENE**. Carbon tetrachloride is produced in a technical grade for fire extinguishers and for solvent purposes, and in a sulphur-free grade for use as a sheep drench. Perchlorethylene is used as an industrial solvent and as an anthelmintic for sheep. Trichlorethylene is used for degreasing and dry cleaning.

METHANOL is produced at some of the synthetic-ammonia plants and also at the charcoal-iron works at Wundowie, in Western Australia. Supplies are supplemented by imports, largely to maintain adequate local production of **FORMALDEHYDE** which is extensively used in the manufacture of synthetic resins.

HEXAMINE has been produced in Australia, but local requirements are now met by imports. The principal use of hexamine in Australia is in the manufacture of phenolic and urea moulding powders. Imports for the years

1946-50 were as follows: 1946-47, 182 tons, £27,532; 1947-48, 151 tons, £29,844; 1948-49, 264 tons, £50,978; 1949-50, 107 tons, £16,460.

The extensive Australian sugar-cane industry makes possible the production of large quantities of **ETHANOL** (power and industrial alcohol, methylated spirit), from molasses. Demand is being met, but if the chemical uses of ethanol increase shortages may result.

ACETIC ACID is produced in adequate quantities. The fermentation process introduced during the war has supplied the largest amount, and lesser quantities are produced from imported acetates, as a by-product of the manufacture of aspirin, and recently from wood distillation. Two new sources, one of which is associated with a large-scale project by CSR for the production of cellulose acetate, are now provided by the synthetic manufacture of acetic acid from alcohol, and this has led to cessation of production by fermentation.

Production of **ACETONE** from molasses by fermentation was commenced early in the war and the present output of the sole Australian manufacturer is sufficient to meet all requirements.

The production of **BUTYL ALCOHOL** by fermentation was established by the same firm during the war and **BUTYL ACETATE** was also manufactured. Output has never been able to meet requirements and substantial imports of both these chemicals have been necessary.

The same firm has been engaged in the production of **LACTIC ACID** for many years and has supplied a major portion of the local demand for technical and edible grades. However, the company recently abandoned manufacture and lactic acid is no longer produced in Australia. Imports for 1948-49 were 14 tons valued at £3,013, and for 1949-50 were 59 tons valued at £9,594.

ETHYL ACETATE has been produced in Australia for many years and output now appears to be adequate to requirements.

ETHYLENE is manufactured in small quantities from alcohol, but its cost from this source is high. Other ethylene chemicals made in limited or small quantities are ethylene oxide, ethylene chlorhydrin, ethylene dichloride and some ethylene glycol esters. The possibility of recovering ethylene from coke-oven gas has received attention, but nothing has eventuated so far.

The manufacture in Australia of anaesthetic B.P. grades of **ETHYL ETHER** and **ETHYL CHLORIDE** was pioneered by one company over thirty years ago. One or two other companies have entered this field in recent years and Australia is now independent of imports of both these chemicals.

The manufacture of **CHLOROFORM** was recently undertaken by one firm, but production in 1948-49 was supplemented by imports to the extent of 4,655 gallons, valued at £10,937; in 1949-50 imports were 5,574 gallons valued at £11,932.

METHYL CHLORIDE, refrigerant grade, is produced in Australia by one firm. Output is insufficient to meet requirements and imports are necessary: 74 tons valued at £16,540 were imported in 1948-49, and 84 tons valued at £19,621 in 1949-50.

The manufacture of **CITRIC ACID**, **POTASSIUM CITRATE**, **TARTARIC ACID**, **CREAM**

OF TARTAR and ROCHELLE SALT is in the hands of one company, which has been established in this field for many years and whose output meets most of the local demand for these chemicals, although some quantities are imported. Citric acid is made from imported calcium citrate. Local supplies of argol are insufficient for the production of tartaric acid and cream of tartar, and are supplemented by imports of argols from Europe.

There is one company in Australia which specialises in the production of CRUDE TARTARS from grape residues. It is located in South Australia. Seeds and skins are collected from various wineries and processed. Tartar settling on the sides of vats is also recovered. It was formerly the practice in wineries to allow the wine to settle, and the lees contained most of the tartar, but from 1932-34 it became the practice to handle wine as quickly as possible, with consequent reduction of the tartar content of the lees.

There may be scope for further enterprises of this type to become established in other wine-producing areas, such as the Hunter River district of New South Wales.

The production of LANOLIN (to B.P. standard) is mainly carried out by one firm, which processes wool grease recovered from a few woolscouring works. The local market is supplied and there is also an export trade. Exports of lanolin for 1948-49 were 176 tons valued at £22,169, while in 1949-50 the quantity doubled to 358 tons, valued at £41,945.

A development of interest has been the production by Elliotts of WOOL-WAX DERIVATIVES, such as cholesterol and wool-wax alcohols.

The only WAXES produced in Australia (other than wool-wax) are BEESWAX and a small quantity of SUGARCANE WAX. The latter is recovered by only one firm, and efforts are being made towards greater production and improved quality, with the object of reducing to some extent the large imports of waxes, for some of which, such as candelilla, sugarcane wax is an effective substitute.

The sole manufacturer of VEGETABLE TANNIN is located in Western Australia; the principal raw material used is the wood of the Wandoo tree (*Eucalyptus redunca* var. *elata*). The product contains 60 to 63 per cent. tannin, conforming closely in analysis to extracts of oak and chestnut. Production is by no means sufficient to meet the requirements of the tanning industry, and large quantities of vegetable tannins are imported. Australian production of wattle bark (*Acacia* spp.) has declined markedly since the war, mainly because of shortage of labour. Action is being taken in Western Australia to increase production of tanning bark from the Mallet tree (*Eucalyptus astrangens*). (See Chapter 3 for comment on tanning barks.) Three firms in Australia make SYNTHETIC TANNINS, but to what extent output satisfies demand is unknown.

Reagent Chemicals

A small number of firms in Australia produce reagent chemicals to accepted standards of purity. The range manufactured is fairly extensive.

Plastic Intermediates

Australian production of chemical intermediates for the manufacture of plastics expanded swiftly during the war from very small pre-war beginnings. The post-war market provided for certain chemicals by the plastics industry has been a most important factor in stabilising the development of basic chemical production in Australia.

The local production of synthetic phenol from benzol and of formaldehyde from synthetic methanol provided the raw materials for the production of PHENOLIC RESINS and MOULDING POWDERS. These plastics are the ones most used in Australia, and local productive capacity is now able to meet the whole of the demand, which is about 4,000 tons a year. Cresol- and xylenol-formaldehyde resins are also manufactured.

The major portion of the Australian demand for UREA RESINS and MOULDING POWDERS is now met by local production from imported urea. MELAMINE RESINS and MOULDING POWDERS are also manufactured in Australia, the melamine being imported.

An important development was the recent commencement of production by ICIANZ of POLYVINYL CHLORIDE, which is being increasingly used in Australia. Capacity is being increased to achieve an output of 6,000 tons a year.

An outstanding project is that of CSR for the production of CELLULOSE ACETATE for the manufacture of rayon and moulding powder for the first time in Australia. The total cost of the undertaking is estimated at £2½ million. In addition to cellulose acetate, several organic chemicals, all at present imported and including acetic anhydride, will also be produced and production of both these and the plastic will eventually be sufficient to meet Australian requirements. The factory began producing acetic acid early in 1950. Completion of the project is expected in 1953.

POLYSTYRENE has been very extensively used in Australia in recent years. At present it is wholly imported, but plans for its production in this country from imported styrene monomer have been announced by Monsanto.

Other notable features of the development of the chemical side of the plastics industry include the manufacture of SYNTHETIC-RESIN GLUES, COUMARONE - INDENE RESINS, ALKYD RESINS—both glycerol phthalate and maleic types—for surface coatings, and a wide range of PLASTICISERS, among which tricresyl and triphenyl phosphates are notable exceptions; however, it is understood that the manufacture of tricresyl phosphate is to begin shortly.

CASEIN FORMALDEHYDE is produced in Australia from locally made RENNET CASEIN, supplies of which are ample; consumption, however, began to decline considerably in 1947-48. LACTIC CASEIN is also made, being largely used for plywood glues; at present it is in short supply.

The following is a statement of imports of plastic intermediates for the year 1949-50—

CHEMICAL AND ASSOCIATED INDUSTRIES

IMPORTS:	1949-50 tons
Phenolic resins (including Phenol-, Cresol-, and Xylenol-formaldehyde and Phenol-, Cresol-, and Xylenol-furfural resins)	200
Alkyd resins, by type (including Phthalic- and Maleic-anhydride type)	26
Organic nitrogen resins (Amino resins) (including Urea-, Thiourea-, Melamine- and Amiline-formaldehyde resins)	579
Other Condensation (thermosetting) plastics (including Lignin plastics and Ester Gum resins)	28
Acrylic resins (including Polymethyl Methacrylate and other Methacrylate resins)	68
Vinyl resins (including Polyvinyl-Chloride and Polyvinyl Chloride-acetate Copolymer resins)	762
Polyolefin and Polyaromatic resins, except Polystyrene resins, including Polyethylene	214
Polystyrene resins	1060
Miscellaneous polymerisation resins	75
Casein plastics	—
Other protein plastics	3
Cellulose nitrate plastics	1
Other cellulose plastics (including other Cellulose Ester plastics and Ester plastics)	547
Carbohydrate plastics except cellulose plastics	—

Imports of plastics materials in block, sheets, rods, tubes or similar basic forms, for the year 1949-50 were as follows—

IMPORTS:	1949-50 tons
Casein or containing Casein	210
Celluloid	8
Cellulose Acetate (except when suitable for use as wrapping paper)	69
Other plastic moulding materials—	
Pliable	387
Non-pliable	264

Explosives (Industrial) and Fireworks

The manufacture of industrial explosives in Australia is solely carried out by a subsidiary of ICIANZ which operates a group of factories producing explosives, fuse and ammunition. Products include NITRO-GLYCERINE EXPLOSIVES, BLACK POWDER, FUSE POWDERS and SAFETY FUSE, to meet requirements for mining, quarrying, public works, etc.; also DETONATORS, PRIMING CAPS and SPORTING CARTRIDGES (SHOT GUN, RIM FIRE and CENTRE FIRE). The company recently completed a project, costing £500,000, modernising the manufacture of commercial explosives in Australia. FIREWORKS are produced in Australia by a few small firms, but there are also substantial imports, mainly from the United Kingdom. Total imports for 1947-48, 1948-49 and 1949-50 were valued at £71,169, £225,979 and £149,518 respectively.

(Manufacture of explosives and allied materials, and the filling of ammunition, mines, pyrotechnic stores, etc., for the requirements of the Armed Services is almost entirely carried on in Australia within establishments owned and operated by the Commonwealth Government specifically for that purpose.)

Insecticides, Fungicides, Weedicides, Pesticides

This group of manufacturing activities is reasonably well covered in Australia.

There is considerable output of general purpose insecticidal sprays and powders for use against flies, mosquitoes, moths, silverfish, etc., the active constituents usually being PYRETHRINS (extracted from imported pyrethrum flowers) and D.D.T. (locally produced). Sprays for agricultural and horticultural use are produced with a wide variety of ingredients, many of which are locally made.

The production of D.D.T. was first begun in Australia to meet wartime needs. Plant capacities have since been expanded and production

is now adequate to meet demand. Another important insecticide—BENZENE HEXACHLORIDE—is also produced in Australia.

Some newly-developed insecticides which have recently come into production overseas are not as yet manufactured in Australia. These include the "Pyrenone" types (made by combining piperonyl compounds with pyrethrum), chlorinated camphenes, "Chlordane", TEPP (tetraethyl pyrophosphate) and selective and systemic insecticides of the "Pestox 3" type, containing phosphorus in organic combination.

NICOTINE SULPHATE (40 per cent.) was made by one firm in Australia for some years from waste tobacco, but production ceased in 1949. Output was only a small fraction of local requirements, which at the present time are estimated at 200,000 lbs. a year. Another company cultivated *Nicotiana rustica* for the production of nicotine sulphate from 1946 to 1948, when the project was abandoned as uneconomic.

The manufacture of arsenical preparations (sheep and cattle dips, weed killers, etc.) has long been established in Australia, and the field is well covered. Until shortly after the war, Australian requirements of ARSENIUS OXIDE had been met for many years by the large quantity produced as a by-product of gold mining at Wiluna in Western Australia. With the cessation of gold output from this mine, local production of arsenic fell to negligible proportions and Australia is now dependent on imports, mainly from Sweden.

Weedkillers of the non-specific type, such as SODIUM ARSENITE and CHLORATE preparations, are provided by local manufacture.

The manufacture of SELECTIVE WEEDICIDES has been established; examples are dinitro-orthocresol, phenoxyacetates, 2,4-D. and 2,4,5-T.

PENTACHLOROPHENOL is a product newly manufactured in Australia, having applications both as a general weed killer and as a preservative of wood and hides. CHLOROPICRIN—the rabbit poison—is another new product. Both these chemicals are also imported.

SALICYLANILIDE was first produced during the war, being extensively used for the tropic-proofing of Service stores. It is now used in fungicidal preparations with special application to foodstuffs.

A recent addition to the fungicides manufactured in Australia is D.D.M. (dichlorodihydroxydiphenyl methane).

Essential Oils, Flavouring and Perfumery Chemicals

The EUCALYPTUS OIL industry is important to Australia, and several firms are engaged in it. Exports are considerable, although those to the United States of America have declined over the last few years owing to competition from Spain, Portugal and the Belgian Congo. From bush distilleries the various types of oil move to city refineries for the production of industrial, medicinal and perfumery grades, phellandrene, cineol, piperitone, etc., and derivatives such as menthol and thymol.

Other essential oils produced in Australia from native raw materials include boronia, lavender, lemon, orange and sandalwood. *Mentha piperita* is not grown in Australia, and

considerable quantities of peppermint oil of various grades are imported, total imports for 1948-49 being 30,241 lbs. valued at £54,008, and for 1949-50 30,390 lbs. valued at £86,544.

A considerable range of FLAVOURING CHEMICALS is produced in Australia, many of them being made from imported materials.

PERFUMERY CHEMICALS—essential oils, natural isolates and synthetic aromatics—are produced in Australia by a small number of firms, but the range in each category is limited and they are used in perfume manufacture mainly for preparations of the cologne type. These locally-produced raw materials are, however, used to a considerable extent for the perfuming of soaps, cosmetics and toilet preparations manufactured in Australia. Although the Australian bottled-perfume industry in itself does not offer great scope to local manufacturers of perfumery chemicals to increase their range of products or to engage in the compounding of perfume concentrates, nevertheless progress has been made in this direction, and there is likely to be further development in this field.

Pharmaceutical Chemicals, Drugs, Vaccines, etc.

Considerable developments occurred in this field of manufacture in Australia during the war. Some of them were wartime projects only, but the production of many important items has been maintained.

The manufacture of SULPHA DRUGS on a large scale was undertaken to meet wartime needs. Monsanto is at present producing a range of these drugs, largely from imported intermediates.

The manufacture of ASPIRIN (acetyl salicylic acid) from imported salicylic acid had been established in Australia for many years prior to the war. In 1941 the manufacturing company commenced the production of SALICYLIC ACID from phenol. Acetic anhydride, the other necessary raw material, continues to be imported, but its manufacture is projected by CSR.

Production of THEOBROMINE, CAFFEINE and PHENACETIN was commenced in a new factory in South Australia early in the war, and the manufacture of these drugs still continues. Output, however, does not fully satisfy requirements. Imports of theobromine for 1948-49 were valued at £5,135, and for 1949-50 £6,559. Imports of caffeine in 1948-49 were 1½ tons, valued at £6,956 and in 1949-50 were 2½ tons, valued at £9,703. Imports of phenacetin in 1948-49 were 90 tons valued at £69,488, and in 1949-50 were 36 tons valued at £26,168.

COMPOUNDED PHARMACEUTICALS, PROPRIETARY MEDICINES AND REMEDIES, AND VETERINARY PREPARATIONS

The value of imports in 1948-49 of unspecified pharmaceutical preparations, drugs and medical preparations (excluding patent and proprietary medicines, etc., and also excluding quinine and any drugs or pharmaceuticals referred to in preceding paragraphs), totalled £441,187, and in 1949-50 totalled £415,452.

The value of production in Australia during 1948-49 of PROPRIETARY MEDICINES (liquids, ointments, pills, tablets, powders and galenicals) totalled £5,994,000, and for 1949-50 totalled £6,717,938.

An achievement in wartime drug manufacture was the production of the related alkaloids of the ATROPINE GROUP from native species of the shrub *Duboisia*. The manufacture of these drugs has been continued up to the present.

A development of value to Australia's sheep-growing industry is the local manufacture by ICIANZ of the anthelmintic PHENOTHIAZINE, production of which began during the war.

The manufacture of PENICILLIN was undertaken by Commonwealth Serum Laboratories at Melbourne in 1944. Production has been continued on a permanent basis, but is not yet meeting local demands, 507,203 million Oxford Units, valued at £213,800, having been imported in 1948-49 and 1,159,398 million O.U. valued at £364,840 in 1949-50. Small quantities of another anti-biotic — STREPTOMYCIN—have been made.

This government-owned organisation also produces a wide range of SERA and VACCINES for human and veterinary use, including sufficient of the anti-tuberculosis vaccine B.C.G. to supply the needs of Australia and New Zealand. Other products are ANTI-ALLERGIC EXTRACTS and ANTI-VENENES for snake-bite.

Biological products for veterinary use—antitoxins, sera, vaccines—are also made by several private firms.

Commonwealth Serum Laboratories first produced the hormone INSULIN in 1923, and output is still expanding, but has not yet overtaken the demand, 63,647,480 International Units, valued at £34,853, having been imported in 1948-49, and 64,679,011 I.U. valued at £48,721 in 1949-50.

The manufacture of CHLORAMPHENICOL is a recent development by Monsanto in conjunction with Parke, Davis & Co. Ltd.

In the field of antiseptics, the production of PROFLAVINE began in 1942, and in post-war years the AMINO-ACRIDINES have been manufactured.

VITAMINS produced in Australia are ascorbic acid (C) and nicotinic acid (P-P). Oil containing a high concentration of vitamin A is extracted from shark livers. The value of vitamins and vitamin powders imported in 1948-49 was £51,303, and in 1949-50 was £118,045.

The BARBITURATE DRUGS are not made in Australia. The value of imports in 1948-49 of unspecified hypnotic and narcotic drugs (other than cocaine, opium and its derivatives) was £24,901, and in 1949-50 was £25,575.

The value of imports in 1948-49 of patent and proprietary medicines, drugs and medicinal preparations (except aspirin tablets) was £469,134, and in 1949-50 was £629,884.

VETERINARY PREPARATIONS (mostly proprietary lines) are compounded in Australia, partly from imported materials and partly from those locally produced (e.g., arsenic, D.D.T., B.H.C., phenothiazene, nicotine sulphate, copper sulphate, carbon tetrachloride, etc.). All products must be registered with State Departments of Agriculture, which assist in maintaining quality.

COSMETIC AND TOILET PREPARATIONS

This industry is well developed and firmly established in Australia. Local consumption has increased considerably above pre-war levels, and has been accompanied by a marked increase in local production. The competitive position of Australian manufacture in regard to imports has been improved by the transfer-

ence of foreign firms to this country. The value of production in Australia during 1948-49 of toilet preparations (cosmetic creams and lotions, dentifrices, hair preparations, face and talc powders, lipstick, rouge, toilet and shaving soaps, toilet lanoline) totalled £5,372,000, and for 1949-50 totalled £6,235,666.

PAINTS, VARNISHES, LACQUERS, PIGMENTS AND OTHER INGREDIENTS

At the outbreak of war, there was already established in this industry in Australia a well-organised and highly efficient group of manufacturing plants. The expansion of the industry since then has been progressive and consistent, despite shortages of certain raw materials which have occurred during the intervening years. In the post-war period many small firms have entered the industry, and there has been considerable extension by established firms, new factories having been erected in many States and new equipment installed. Several prominent manufacturers are currently completing programmes of expansion. The field is now highly competitive, and it would seem that a stage has been reached where productive capacity is ample.

The remarkable growth of the industry is well illustrated by the great increases in the production of major items between 1938-39 and 1948-49. Production of PAINTS (oil and ready mixed) increased by 76 per cent. from 2,097,306 gal. to 3,695,583 gal., VARNISHES for sale by 73 per cent. from 537,110 gal. to 928,799 gal., nitro-cellulose LACQUERS by 44 per cent. from 576,276 gal. to 829,971 gal., ENAMELS by 280 per cent. from 191,671 gal. to 727,953 gal., and SYNTHETIC FINISHES by 171 per cent. from 364,245 gal. to 988,586 gal. These increases total approximately 3,404,000 gal.—equivalent to an overall rise of 90 per cent.

Associated with this expansion of finished products has been the development of the local manufacture of raw materials consumed by the industry.

A wide range of basic PIGMENTS is made in Australia, the only outstanding exception being lithopone. A recent development was the establishment of an additional plant to produce CHEMICAL COLOURS comprising both inorganic and organic pigments; these have been made in Australia for some time to a limited degree, but imports remain considerable.

WHITE LEAD has been made in Australia for many years by two paint manufacturers using the old corrosion or Dutch process; one of these firms is believed to have recently adopted another process. Adequate productive capacity for this material has now been assured by the establishment of a new firm specialising in producing white lead by a modern precipitation process. The new factory commenced production in the middle of 1949. Australian production for 1949-50 of white lead for sale totalled 8,328 tons valued at £583,886.

An event of importance in the field of pigment manufacture was the establishment of a factory in Tasmania for the production of TITANIUM DIOXIDE for the first time in Australia. The plant came into operation in January, 1949, with a declared target output of 1,800 tons a year initially, rising to approximately 3,500 tons by about 1952. The type of titanium dioxide produced is rutile, the raw material used being ilmenite from India. The anatase variety is entirely imported. The market for titanium pigments has grown rapidly during the last decade, and supplies throughout the world cannot meet demands. Australian imports for 1948-49 were 1,339 tons valued at £222,419, and for 1949-50 2,203 tons valued at £336,637.

The manufacture of LEAD OXIDES is largely associated with the paint industry. Production includes litharge, red lead and battery oxide. Output of red lead for 1948-49 was 3,207 tons, valued at £163,738.

ZINC OXIDE is produced by several firms, mainly in New South Wales, in various grades. While manufacturing capacity is adequate, supplies are restricted by limited local allocations of zinc. The paint and rubber industries are the major consumers of zinc oxide. Production for sale was 12,390 tons in 1948-49, and 11,620 tons in 1949-50.

The production of SYNTHETIC IRON OXIDE has recently been commenced by one firm in Australia. To what extent output will satisfy demand is unknown. Imports of iron-oxide pigments for 1948-49 were 1,472 tons valued at £77,392, and for 1949-50 were 2,116 tons valued at £87,071, but this item would include other varieties of iron-oxide pigments, such as ochres, siennas, and perhaps umbers, in addition to the synthetic type.

Lacquer grades of NITRO-CELLULOSE are made by ICIANZ (also making nitrocellulose-coated leathercloth). Supplies are believed to be adequate.

The market for DRIERS is well covered. Several firms manufacture METALLIC SOAPS (mainly stearates of aluminium, calcium, lead, magnesium and zinc). Although chiefly used by the paint industry, some have other applications. A number of firms produce NAPHTHENATES (of cobalt, copper, lead, manganese and zinc). Copper naphthenate is extensively used for rot-proofing wood and fabrics.

Special grades of SYNTHETIC RESINS are made for incorporation in surface coatings. Plant capacity is believed to be adequate for requirements.

VEGETABLE OILS

A number of the more important of these oils are produced in Australia, some from imported seeds or nuts and some from those locally grown.

CASTOR OIL is produced in considerable quantity from imported beans. Whilst there have been successful tests with the local growing of castor plants, prospects that this country

will be able to produce its own requirements of castor beans depend on economic harvesting. **DEHYDRATED CASTOR OIL** is manufactured as a tung-oil substitute. **SULPHONATED CASTOR OIL** is also produced.

COCONUT OIL is produced in various grades from imported copra. Some of the oil is hydrogenated.

MAIZE OIL, a by-product of maize-starch manufacture, is produced from locally-grown maize. Prevailing high prices for maize have restricted the output of the oil.

The growing of peanuts is a valuable primary industry, located in northern Australia, but only limited quantities of **PEANUT OIL** are extracted.

Limited quantities of **COTTONSEED OIL** are derived from the small cotton-growing industry in Queensland, and also from the treatment of imported seed.

Australia produces a portion of its requirements of **OLIVE OIL** from locally grown olives. Plans are in hand to increase the cultivation of olive trees.

A new product in the field of vegetable oil production in Australia is **SUNFLOWER-SEED OIL**, which has been developed largely in response to the general shortage of edible vegetable oils in Australia. So far this oil has been mostly produced from imported seed, but steps are being taken to place sunflower cultivation on a commercial basis in Australia. The use of the oil is not restricted to edible purposes, and some of that produced is used in the manufacture of paints. It also has other industrial applications.

RAPSEED OIL is produced mainly from imported seed.

The production of **LINSEED OIL** from imported seed has been established in Australia for many years. A most important post-war development was the growing of linseed in Aus-

tralia, which is now well established. Serious shortages of linseed oil have occurred in recent years, and it is hoped that Australia will eventually become self-sufficient in respect of linseed supplies. Seed has been sown in several States, but New South Wales and Queensland have by far the largest acreages under crop.

A small amount of **TUNG OIL** is produced from locally grown nuts, but Australia is mainly dependent on imported oil and that expressed from imported nuts. It has been shown that the tung tree can be grown satisfactorily in the North Coast district of New South Wales, and efforts have been made, so far without much success, to stimulate the cultivation of tung trees. In 1948-49 the quantity of tung oil imported into Australia (mainly from China) was 347,286 gallons, valued at £248,219, and in 1949-50 264,935 gallons valued at £215,686.

Largely in response to the acute shortages of linseed oil which occurred a few years ago, various other vegetable oils have come into prominence in Australia as possible substitutes. **CANDLENUT OIL**, the nearest equivalent to linseed oil, has been commercially produced, mainly from imported nuts, there being considerable difficulties associated with the collection of nuts from native trees growing in northern Queensland. Cultivation of the **SOYA BEAN** has not as yet been successfully undertaken in Australia, and production of the oil has been mainly experimental. Experiments have been carried out with the growing of **SAFFLOWER**, but prospects for the commercial production of the oil from locally grown seed have not yet been realised.

Statistics of production of vegetable oils are not recorded for all of the foregoing items, those for 1949-50 comprising the following: coconut oil (refined) 4,602 tons, linseed oil 3,657,972 gal., olive oil 6,286 gal., peanut oil 226,697 gal.

SOAPS, GLYCERINE, FATTY ACIDS, DETERGENTS

The Australian soap industry is well established, and all requirements are fully met. Production covers all varieties, the quantities produced in 1949-50 being as follows: household soaps 29,966 tons, toilet soaps 13,388 tons, shaving soaps and creams 450 tons, shampoos 459 tons, laundry flakes and chips 2,583 tons, industrial soap (including soap produced by woolscouring establishments for their own use) 3,996 tons, industrial flakes and chips 384 tons, sandsoap 2,249 tons, soft soap 978 tons, liquid soap 4,225 tons, soap extracts and powders 34,892 tons, cleansing and scouring powders 3,119 tons.

Candles are produced by the industry in sufficient quantity to satisfy the demand, production for 1949-50 being 1,062 tons.

A most important chemical by-product of the industry is **GLYCERINE**. Production has fluctuated during the post-war period, but output for 1948-49 was substantially raised above that for the previous years, production of refined glycerine for sale being 3,155 tons, and for 1949-50, 3,346 tons. Nevertheless, the present supply in relation to demand is believed to be inadequate.

The industry is also a large producer of **STEARIC** and **OLEIC ACIDS**, although these materials are also produced by manufacturers outside the soap industry.

FATTY ACIDS are also produced in Australia from coconut and linseed oil.

FATTY ALCOHOLS are made by several firms in Australia from imported raw materials. An example is cetyl alcohol made from imported sperm oil.

Quantities of various **SURFACE-ACTIVE PREPARATIONS**, embracing **SYNTHETIC DETERGENTS** and **WETTING AGENTS**, are produced in Australia. They are mostly used for special purposes. Sulphonated oils and sulphonated fatty alcohols have particular application to the tanning and textile trades, and several firms specialise in their production. Other preparations are compounded, some having an alkyl aryl sulphonate base such as sodium dibutyl naphthalene sulphonate. Compounded detergents containing soluble phosphates are manufactured in quantity for industrial cleaning.

However, local production of surface-active agents does not cover the extensive range manufactured overseas, and several preparations are imported. Non-ionic detergents are not as yet manufactured in Australia. Imports of soap substitutes and compounded detergents for 1948-49 amounted to 516 tons valued at £64,006, and for 1949-50 388 tons valued at £56,701.

Synthetic detergents, owing to their cost, are unlikely to become competitive with soap in

Australia for general purposes, as long as there is a good supply of cheap tallow in this country.

INKS, ADHESIVES, POLISHES

There has been significant development in PRINTING INK manufacture in Australia in the post-war period. The pre-war manufacturers, although few in number, were already supplying most of the needs of the printing industry; imports were mainly of special grades, particularly metallic inks. Increased demand and the desire of the printing industry for inks of even higher performance encouraged the larger of the established manufacturers to consolidate their position by expansion, and, in two instances, by association with prominent overseas manufacturers. In addition, two leading U.K. printing-ink manufacturers recently established factories in Australia, one of them in association with its Australian agents.

The production of printing and lithographic ink in 1948-49 was 10.2 million lbs., valued at £839,191, and in 1949-50 was 11.7 million lbs. valued at £1,039,366, compared with 1938-39 production valued at £370,949 (quantity statistics were not available in 1938-39). Imports for 1948-49 were valued at £96,724, and exports at £12,342; imports for 1949-50 were valued at £49,687 and exports at £9,129.

PRINTERS' ROLLER COMPOSITION valued at £18,650 was made in 1948-49, compared with £19,290 in 1938-39. Imports and exports were negligible. Most of the composition made is used by the makers (mainly four of the major inkmakers) in re-making of press rollers as a trade service to the printing industry.

Imports of WRITING INK have been larger of recent years than previously. A shortage of bottles in Australia, together with the demand for certain overseas brands of ink associated in advertising with certain fountain pens contributed to increased imports, which in 1948-49 were valued at £30,006, and in 1949-50 were valued at £16,132, compared with £9,660 in 1938-39. The value of writing and drawing inks produced in Australia in 1948-49 was £100,600, compared with £34,020 in 1938-39; exports were valued at £6,610 in 1948-49 and £5,680 in 1949-50. Since 1948-49, the manufacture in Australia of some popular brands of ink formerly imported has become well established.

Capacity for manufacture of DRAWING and SHOWCARD INKS, POSTER COLOURS, STAMP-PAD INKS, DUPLICATING INKS,

appears to have been sufficient to meet demand for lines of ordinary commercial standard. HIGH-GRADE ARTISTS' COLOURS, however, are practically all imported. A major European firm manufacturing poster colours, artists' colours, writing and duplicating inks, is now establishing itself in Australia in the manufacture of poster colours and certain stationery lines.

MUCILAGE and PASTE production in 1948-49 was valued at £20,250 and £37,650 respectively.

Production of INDUSTRIAL ADHESIVES and CEMENTS (excluding those made within the rubber industry) was 78,784 cwt. in 1949-50 and 111,750 cwt. in 1948-49, compared with 62,600 cwt. in 1945-46 (the first year for which quantity statistics were collected). 1948-49 output was as follows—

PRODUCTION:		1948-49	
		cwt.	£
Powdered adhesives	28,600	118,913	
Semi-liquid adhesives	27,185	87,990	
Liquid adhesives	32,890	160,178	
Other adhesives	23,060	51,600	
Total	111,735	£418,682	

The output of POLISHES in Australia has kept up with demand to the extent that the quantity of imports in 1948-49 is less than in 1938-39, and total production and exports are much higher. The following table compares production, imports and exports for 1938-39 with 1948-49—

PRODUCTION:		1938-39	1948-49
Automobile polish	£14,165	£50,841	
Floor wax (solid)	170,726	371,454	
Wax and polish (liquid)	31,384	130,813	
Brass polish	78,426	58,609	
Furniture polish	3,479	8,888	
Boot and shoe polishes and dress- ing	259,238	409,595	
Stove polish	61,538	65,420	
Silver polish	—	18,943	
Total production	£618,956	£1,114,563	

IMPORTS:		1938-39	1948-49
Floor and furniture polish (oils and pastes)	£4,079	£2,307	
Boot and shoe polish	1,295	198	
Inks, stains and paints for leather	4,842	4,220	
Knife, metal and stove polishes	11,519	10,076	
Total imports	£21,735	£16,821	

EXPORTS:		1938-39	1948-49
Boot and shoe polish and dress- ing	£21,615	£85,532	

MAJOR DEFICIENCIES IN MANUFACTURE

This section is intended to indicate the present major deficiencies or gaps in the Australian chemical and associated industries and gives separate treatment to certain chemical materials which are not produced in Australia or are made to only a limited extent and which might perhaps with advantage be manufactured in this country by new or existing enterprise.

The criteria adopted for the inclusion of an item in this section are that the material in question is either not manufactured in Australia or is produced to only a small degree, and that the import values are significant. DYESTUFFS are not included, since it seems

to be generally acknowledged that the absorptive capacity of the Australian market is insufficient to justify the establishment here of this branch of the chemical industry. Nevertheless, there may prove to be some scope for the production in this country of a limited number of intermediates and synthetic dyestuffs, and this aspect should not be overlooked.

It will be seen that the items listed are variable in their connotations; some are suited to comparatively small scale enterprise, some are major projects calling for heavy capitalisation, while others occupy an intermediate position.

It is desirable to emphasise that whether these superficially apparent opportunities for new enterprise could actually be sustained as affording favourable prospects could only be determined by a comprehensive investigation of each project and an exhaustive assessment of all the economic, technical and other factors involved.

The items are arranged for convenience in alphabetical order and are as follows—

Activated carbon
Barium salts
Bromine, bromides and bromates
Carbon black
Cyanides (of calcium, potassium and sodium)
Formic and oxalic acids
Hydrosulphites
Lecithin
Lithopone
Liver extracts
Mercury salts
Nickel salts
Potassium carbonate and potassium hydroxide
Saccharin
Sulphur (elemental)
Tetraethyl lead
Urea

Activated Carbon

Activated carbon was produced in Australia during the war under an agreement with the patentees of the particular process used. The raw materials were coconut shells and peach stones. In accordance with the terms of the agreement, the plant was dismantled at the end of the war and this country has since been dependent on imports. These have declined over recent years, while the relative monetary value of the material has greatly increased, as shown below—

IMPORTS:

	tons	£
1946-47	313	14,744
1947-48	74	8,119
1948-49	54	12,056
1949-50	75	10,576

Activated carbon is used in Australia for de-colourising wine, solvent recovery, clarification of honey, purification of oils, chemicals, etc.

The import figures quoted above may not give a reliable indication of the general ten-

IMPORTS:	Potassium Bromate		Potassium Bromide		Bromates and Bromides n.e.i.		Total, Bromates and Bromides	
	tons	£	tons	£	tons	£	tons	£
1946-47	7	2,077	38	11,430	16	5,605	61	19,112
1947-48	2	800	63	17,101	35	16,718	100	34,619
1948-49	10	4,715	41	12,406	17	12,198	68	29,319
1949-50	6	3,460	36	10,617	15	9,919	57	23,996

Carbon Black

The possibility of manufacturing this important material in Australia has received considerable attention, but at present there are no known plans for its production in this country. Supplies are imported from the United States of America.

In view of the importance of carbon black to the rubber industry and of the large dollar expenditure involved in its importation, the establishment of the manufacture of this material in Australia is a matter of considerable consequence.

Carbon black is not recorded as a separate item in Commonwealth import statistics, but is included with other black pigments. However,

it is considered a reasonable assumption that imports under this heading from the United States of America consist entirely of carbon black. This is confirmed by the fact that the quantity of carbon black (so specified) cleared by the Department of Trade and Customs during 1948-49 coincides with the quantity recorded under black pigments as being imported from the United States of America in the same year. Imports from America under this heading for the post-war years were as follows—

IMPORTS:

	tons	£
Barium carbonate—precipitated:		
1946-47	51	1,101
1947-48	299	7,974
1948-49	146	4,727
1949-50	69	3,033
Barium chloride:		
1946-47	100	4,414
1947-48	104	4,943
1948-49	88	4,624
1949-50	105	4,890
Barium sulphate:		
1946-47	168	4,689
1947-48	69	2,117
1948-49	41	2,209
1949-50	141	4,349
Barium salts, n.e.i.:		
1946-47	25	1,039
1947-48	19	793
1948-49	8	1,513
1949-50	9	620
Total barium salts:		
1946-47	344	11,243
1947-48	491	15,827
1948-49	283	13,073
1949-50	324	11,892

Bromine, Bromides and Bromates

None of these chemicals are as yet produced in Australia. The recovery of bromine from salt bitterns and the production of bromides and bromates have been considered, but nothing has so far eventuated.

Imports of bromine are inconsiderable, but appreciable quantities of potassium and other bromides and bromates are imported, as shown below—

IMPORTS:	Potassium Bromate		Potassium Bromide		Bromates and Bromides n.e.i.		Total, Bromates and Bromides	
	tons	£	tons	£	tons	£	tons	£
1946-47	7	2,077	38	11,430	16	5,605	61	19,112
1947-48	2	800	63	17,101	35	16,718	100	34,619
1948-49	10	4,715	41	12,406	17	12,198	68	29,319
1949-50	6	3,460	36	10,617	15	9,919	57	23,996

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	tons	£
1945-46	7,936	310,221
1946-47	6,933	384,770
1947-48	7,278	406,410
1948-49	8,622	509,023
1949-50	7,375	542,497

The main uses of carbon black in Australia are assessed as follows—

- Rubber industry—approximately 90 per cent.
- Printers' ink—approximately 6 per cent.
- Paint industry—approximately 2 per cent.
- Miscellaneous—approximately 2 per cent. (stove polish, gramophone records, carbon paper, stencil inks, etc.).

Australia is deficient in indigenous raw materials for the manufacture of carbon black, the availability of natural gas and shale-oil gas being inadequate. It would therefore be necessary to import the required type of petroleum oil for the purpose. Plans have been announced for the establishment of three cracking refineries in Australia and these may offer a potential source of supply of suitable feed stock for the manufacture of carbon black.

There have been recent developments of interest in the United Kingdom in connection with the production of carbon black, three companies having been formed for its production there. Two of these companies are associated with United States interests which are supplying technical data, etc., in return for cash payments and interests in the firms concerned. The total planned output of these companies, however, is insufficient to meet United Kingdom requirements and exports to Australia are unlikely. Since each of these new enterprises is aiming to produce quantities of carbon black which would comprise the major portion of Australian consumption, they should serve as interesting examples to any firm contemplating manufacture of carbon black in Australia, in respect of methods, possibilities of American assistance and capital outlay.

Cyanides (Calcium, Potassium, Sodium)

Notwithstanding a substantial Australian demand, particularly for sodium cyanide, none of these chemicals are made in Australia; nor, so far as is known, is their manufacture in this country contemplated.

Apart from potassium cyanide, which would require imported potassium carbonate for its manufacture, the production in Australia of calcium and sodium cyanides appears to be a project worthy of consideration.

In regard to the processes which might be used for the manufacture of cyanides in Australia, it is desirable to mention firstly that metallic sodium is not made in this country and that consequently the establishment of production of this metal would be a necessary preliminary to the employment of the Castner process, unless reliance were to be placed on imports.

Secondly, although calcium carbide is made in Australia by one company (in Tasmania), output is below requirements and current expansion of plant capacity offers no hope of meeting increasing demand. Therefore, unless the project were to be dependent on imports, the choice of the cyanamide route to cyanide production would probably require in the first instance the establishment of a new carbide plant. There is also the further aspect of the high cost of synthetic ammonia in this country.

In view of the foregoing, attention might be given to the method of reacting nitrogen and sodium carbonate with a suitable form of carbon.

Imports for the three years 1947-50 are set out below—

IMPORTS:	1947-48		1948-49		1949-50	
	tons	£	tons	£	tons	£
Calcium cyanide	125	12,931	228	25,500	198	41,889
Potassium cyanide	137	9,323	25	3,459	27	6,083
Sodium cyanide	2,720	135,353	4,183	176,663	2,809	198,313
Totals	2,982	157,607	4,436	205,622	3,034	246,285

Formic and Oxalic Acids

In post-war years two or three firms have considered undertaking the manufacture of these acids, but any plans made for commercial production have not been fulfilled and all supplies continue to be imported. Imports for five post-war years are set out below—

IMPORTS:	tons	£
Formic Acid:		
1945-46	182	12,973
1946-47	118	9,096
1947-48	114	12,880
1948-49	186	26,865
1949-50	125	12,227
Oxalic Acid:		
1945-46	64	5,155
1946-47	62	7,918
1947-48	108	22,276
1948-49	71	15,399
1949-50	40	5,004

Hydrosulphites

These chemicals, of which the sodium salt is the most widely used, are important to the textile industry in Australia.

All of the raw materials necessary for their manufacture, namely, metallic zinc, sulphur dioxide and soda ash (also formaldehyde for making Rongalite) are available from Australian production. The manufacture of hydrosulphites in Australia has been considered, but it is believed that the comparatively high local cost of soda ash has been a deterrent. All supplies continue to be imported, mainly from the United Kingdom, but also latterly from the United States of America. Nevertheless,

in view of the significant average value of imports over the last few years and since the plant required for the manufacture of hydrosulphites should be comparatively simple and not very costly, it would seem that the prospects of establishing their manufacture in Australia deserves further investigation.

Imports for the years 1945-50 are set out below—

IMPORTS:	tons	£
1945-46	169	14,438
1946-47	193	19,198
1947-48	288	35,186
1948-49	151	19,444
1949-50	81	11,205

Lecithin

A small quantity of this material was made in Australia during the war by one firm which extracted it from ox brain, but lecithin is not now produced in this country, nor are there any known plans for its manufacture here. Other raw material sources for the production of lecithin, such as cereal grains and vegetable oils, are available in Australia.

Imports are significant in quantity and value and these are set out below for the five post-war years 1945-50—

IMPORTS:	tons	£
1945-46	50	9,442
1946-47	66	16,606
1947-48	34	10,424
1948-49	63	20,411
1949-50	72	20,504

Lithopone

No lithopone is produced in Australia for sale. One firm manufactures a small amount for its own consumption. Two or three firms have contemplated making it during recent years, but so far as is known no plans are in hand for its manufacture and all supplies continue to be imported.

Regarding raw materials for the manufacture of lithopone, Australia has ample indigenous supplies of good-quality barytes for the production of barium sulphide, and locally-produced zinc sulphate is available.

Imports of lithopone for the last pre-war year and five post-war years are set out below. It will be noted that the quantities imported over recent years have progressively increased, indicating that the demand for lithopone is at a high level, notwithstanding the increasing consumption of titanium dioxide.

IMPORTS:

	tons	£
1938-39	2,976	46,352
1945-46	1,330	41,562
1946-47	793	35,337
1947-48	1,704	149,356
1948-49	2,595	162,243
1949-50	4,110	200,911

Liver Extracts

These are produced in Australia to only a limited extent. One firm is known to make an injectable liver extract and one or two firms make liver preparations for oral administration. That the Australian market is a valuable one is indicated by the imports which, for the five years 1945-50 were as follows: 1945-46, £40,012; 1946-47, £70,992; 1947-48, £124,213; 1948-49, £17,979; 1949-50, £50,661. The reason for the wide variations in value in the different years is not known.

Mercury Salts

Some organic mercurials of the type of phenyl mercuric acetate are manufactured in Australia; but no inorganic mercury salts are made in this country at present. The Commonwealth is almost entirely dependent on imports for its supplies of mercury.

Since the manufacture of mercury salts is a comparatively simple process which does not require a large capital outlay on plant, the monetary values of recent yearly imports are significant as indicating a reasonable prospect that the manufacture of these chemicals could be successfully undertaken in Australia.

Relatively large amounts of mercuric nitrate are used in Australia for the treatment of rabbit fur for felting. Other requirements include corrosive sublimate, calomel, mercuric sulphide and red oxide of mercury.

Imports of mercury salts for the post-war years are set out below—

IMPORTS:

	tons	£
1945-46	15	18,255
1946-47	10	13,740
1947-48	6	6,366
1948-49	16	6,902
1949-50	42	14,196

Nickel Salts

There have been reports of the occurrence of nickel ores in Australia and a deposit in Tasmania has received recent attention, but at present all supplies of nickel metal are imported. Nickel oxide was produced for a short time during the war at a munitions annexe

established at Cockle Creek, New South Wales, where nickel matte, imported from New Caledonia, was roasted.

There is only a limited manufacture by one firm of nickel salts for electroplating in Australia. The production of these salts is relatively simple and plant costs should not be high. Values of imports afford an encouraging indication that there may be an opportunity to extend the manufacture of these chemicals in Australia.

Imports of nickel salts for the five years 1945-50 were as follows—

IMPORTS:	Nickel Sulphate (including Nickel- Ammonium Sulphate)		Nickel Salts n.e.i.	
	tons	£	lb.	£
1945-46	48	2,666	672	7,306
1946-47	74	4,852	—	11,687
1947-48	82	7,035	—	14,726
1948-49	95	8,720	—	8,548
1949-50	124	14,274	—	13,087

Potassium Carbonate and Potassium Hydroxide

Australia is dependent on imports of both these chemicals. The extraction of suint from wool has been considered as a promising source, but the high cost of the necessary plant has been a deterrent and nothing has resulted in this direction so far. It was hoped that the State Government enterprise operating on alunite deposits at Lake Chandler in Western Australia would eventually produce potassium chloride, which would in turn make possible the production of the carbonate and hydroxide, but owing to technical difficulties and uneconomic operation the works (which were producing a mixture of potassium and sodium sulphates) were recently closed down for an indefinite period.

Imports for the years 1946-50 are set out below—

IMPORTS:

	tons	£
Potassium carbonate and pearl ashes:		
1946-47	409	21,131
1947-48	643	48,203
1948-49	537	44,708
1949-50	448	34,658
Potassium hydroxide:		
1946-47	487	24,323
1947-48	1,267	86,994
1948-49	847	37,081
1949-50	138	9,081

Saccharin

The manufacture of saccharin commenced in Australia early in the war. In 1948 there were two firms making it. Since then, however, production has ceased. Presumably the local manufacturers are unable to withstand overseas competition. Imports of saccharin and similar substitutes for sugar for the last pre-war year and the five post-war years are set out below—

IMPORTS:

	lb.	£
1938-39	12,201	6,590
1945-46	10,743	8,829
1946-47	9,593	8,622
1947-48	37,373	46,141
1948-49	15,962	14,288
1949-50	10,082	9,041

Sulphur (Elemental)

There are no known deposits of brimstone in Australia and elemental sulphur has not yet been produced in this country. Australia, however, has large reserves of sulphur-bearing minerals, notably pyrite, lead and zinc sulphides and gypsum.

Pyrite and zinc concentrates have been utilised for many years for the production of a portion of Australia's sulphuric-acid requirements (approximately 40 per cent. in 1947-48). Plans are now in hand to use the roaster gases from lead concentrates for this purpose. No move has yet been made to utilise the very large gypsum deposits in the Commonwealth for the production of sulphuric acid.

For the past ten years Australia has depended almost entirely on America for its supplies of brimstone. The dollar element in the cost is about 22 dollars per ton. At least 90 per cent. of the brimstone imported is used for the manufacture of sulphuric acid. Total consumption over the last few years has averaged over 100,000 tons.

The gradual depletion of American resources of brimstone and the restriction of supplies from that source have made it necessary for immediate attention to be given in Australia to the maximum use of indigenous sulphur-bearing minerals for the manufacture of sulphuric acid and also to the prospects of production of elemental sulphur.

A number of processes for the production of elemental sulphur have been developed overseas and some of these may be capable of successful commercial application in Australia. One of the most firmly established processes is the "Orkla" which is applied to pyritic copper ores in Norway, Spain and Portugal. The "Orkla" and other processes are being considered for the treatment of the pyritic copper-gold ore at Mount Morgan in Queensland. The possibilities of producing elemental sulphur at other plants engaged in treating sulphide ores have also been examined, but it is considered that Mount Morgan offers the best prospects.

There remain two remote areas where metallurgical gases containing substantial quantities of sulphur dioxide are being discharged to atmosphere, one at Mount Isa, Queensland, in the treatment of lead ore, the other at Kalgoorlie, Western Australia, in the treatment of gold ore. With brimstone at its present high price, there is a strong incentive to devise economic methods for the recovery of elemental sulphur from these sources.

Tetraethyl Lead

There is no local manufacture of tetraethyl lead, nor immediate prospect of it, all supplies being imported from the United Kingdom. Most of the petrol coming to Australia is already leaded, the imported tetraethyl lead being mainly used to bring deficient imported consignments up to standard and to treat petrol produced in Australian refineries. Nevertheless, imports are significant and there was a very great increase in the imported cost of this material from 1946-47 onwards, as shown below—

IMPORTS:

		tons	£
1946-47	.. .. .	426	10,889
1947-48	.. .. .	341	77,932
1948-49	.. .. .	214	53,886
1949-50	.. .. .	303	95,606

Plans have been announced for the establishment of three cracking refineries in Australia. When these are operating, requirements of tetraethyl lead should greatly increase. In regard to the local availability of raw materials for the manufacture of tetraethyl lead, it is desirable to mention that metallic sodium is not as yet manufactured in Australia.

Urea

This material is not produced in Australia. Import statistics are not separately recorded, but annual requirements are known to be about 1,500 tons.

Urea is used in Australia for the production of urea resins, moulding powders and adhesives.

The cost of ammonia production in the Commonwealth Government's small synthetic plants is too high to permit the economic production of urea and their present output of ammonia is fully taken up for other important purposes. The much larger plant at present being erected in Tasmania by a private organisation is designed for the production of ammonium sulphate.

It seems clear that a project for the manufacture of urea in this country would depend on the establishment of production of cheaper ammonia. Moreover, in order to achieve an economic level of output of urea, it might be necessary to give attention to the production of additional quantities for use as fertiliser.

Part Three: Basic Statistics

COMPARATIVE STATISTICS, 1938-39/1949-50

NUMBER OF ESTABLISHMENTS AT 1938-39 AND 1949-50

NUMBER OF EMPLOYEES AT 1938-39, 1949-50, JUNE 1950, SEPTEMBER 1951

Activity (Statistical Sub-classes used by Commonwealth Statistician, 1949-50)	Establishments		Employees			
	1938-39	1949-50	1938-39	1949-50	June 1950 (a)	Sept. 1951 (a)
Chemical Fertilisers (b)	no. 36	no. 51	no. 2,540	no. 3,889	no. 3,725	no. 3,093
Industrial and Heavy Chemicals and Acids, Explosives and Fireworks (c)	(d)250	199	(d)8,100	9,749	10,194	11,449
Carbide (e)	(e)	(e)	(e)	(e)	(e)	(e)
Pharmaceutical and Toilet Preparations (f)	(d)	205	(d)	5,157	5,631	6,108
White Lead, Paints and Varnishes (g)	102	149	2,271	4,526	4,861	5,266
Inks, Polishes, etc. (h)	70	127	990	1,422	1,418	1,483
Vegetable Oils (j)	30	25	477	669	705	752
Soap and Candles	65	90	2,620	3,646	3,687	3,762
Other (of Class III) (k)	11	21	311	1,068	712	712
Totals (l)	564	867	17,309	30,126	30,933	33,225

STATISTICAL SUMMARY, 1949-50

EMPLOYMENT, MALE AND FEMALE

SALARIES AND WAGES PAID, IN TOTAL AND PER PERSON ENGAGED

VALUE OF PRODUCTION

VALUE OF MATERIALS, POWER, FUEL, REPAIRS, etc.

VALUE OF OUTPUT

See Explanations,
Appendix IV

Activity (Statistical Sub-classes used by Commonwealth Statistician, 1949-50)	Employment			Salaries and Wages Paid		Value of Pro- duction	Value of Materials, Fuel, etc. Used	Value of Output
	Males	Females	Persons	Total	Per Person Engaged			
Chemical Fertilisers (b)	no. 3,760	no. 129	no. 3,889	£'000 2,050	£ 527	£'000 3,993	£'000 13,149	£'000 17,142
Industrial and Heavy Chemicals and Acids, Explosives and Fireworks (c)	8,412	1,337	9,749	4,890	502	9,075	11,586	20,661
Carbide (e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)
Pharmaceutical and Toilet Preparations (f)	2,121	3,036	5,157	1,840	357	6,566	6,444	13,010
White Lead, Paints and Varnishes (g)	3,604	922	4,526	2,097	463	5,296	11,074	16,370
Inks, Polishes, etc. (h)	821	601	1,422	563	396	1,560	2,500	4,060
Vegetable Oils (j)	616	53	669	356	532	1,193	5,400	6,593
Soap and Candles	2,509	1,137	3,646	1,605	440	4,442	5,783	10,225
Other (of Class III) (k)	713	355	1,068	450	421	1,100	1,838	2,938
Totals (l)	22,556	7,570	30,126	13,851	460	33,225	57,774	90,999

Explanatory Footnotes to Both Tables

- (a) These employment figures are taken from monthly payroll-tax returns and differ slightly from the other employment figures, which are supplied on annual factory returns.
- (b) Includes synthetic-ammonia plants associated with chemical-fertiliser manufacture.
- (c) Also includes gases, dry-ice, glycerine, cream of tartar, drugs, vaccines; also the sub-class "Explosives (including Fireworks)" which includes defence-supply establishments owned and operated by the Commonwealth Government, excepting those located in New South Wales.
- (d) At 1938-39 the present sub-classes "Industrial and Heavy Chemicals and Acids" and "Pharmaceutical and Toilet Preparations" made up one sub-class entitled "Chemicals, Drugs and Medicines".
- (e) The sub-class "Carbide" (of the Commonwealth Statistician's Class I, "Treatment of Non-metalliferous Mine and Quarry Products") covers the manufacture of calcium carbide and acetylene black, of which there is only one manufacturer in Australia, a company making only those products, mainly carbide. As is usual where there are less than three manufacturers for a sub-class, the statistics of the sub-class are grouped with another sub-class, in this instance the sub-class "Other" of the Commonwealth Statistician's Class I—see footnote (o), page 42, this study (in Chapter I, "Products of Crude and Treated Non-metallic Minerals"). The activity, however, is dealt with in this study in Chapter 6, "Chemical and Associated Industries".
- (f) Does not include drugs and vaccines. Includes the compounding and/or packing of proprietary medicines and remedies; non-prescriptive pharmaceuticals; household chemical preparations; toilet and cosmetic preparations, tooth paste and powders; perfumes.
- (g) Also includes red lead, zinc oxide and paste, dry colours, pigments, and similar materials; removers; driers, fillers, plastic wood; and porcelain-enamel frits.

- (h) Includes writing inks; printing inks, printers' roller composition; laundry blue; dyes; polishes; mucilage, pastes, industrial adhesives.
- (j) Also includes residue oil, meals and cakes.
- (k) The sub-class "Other" is one of miscellaneous activities not elsewhere included within the Commonwealth Statistician's Class III, "Chemicals, Dyes, Explosives, Paints, Oils, Grease". The sub-class includes compounds for surgical dressings; surgical gut, tennis gut, gut cord; lanoline (refining of wool grease).
- (l) Consideration and comparison of totals must take into account the effects stated in footnotes explaining the composition of certain sub-classes and figure units.

Chapter 7 :

PLASTICS PRODUCTS

Part One: Structure of Established Manufacturing Activities

THE manufacture of plastics products in Australia, from resins, moulding powders, etc., and from semi-processed materials (film, sheet, rod, tube, etc.) is undertaken both by the plastics industry proper and also by firms engaged mainly in the manufacture of other articles, but incorporating component parts of plastics. The description of activities set out below is intended to be reasonably indicative, but not necessarily fully inclusive.

PLASTICS INDUSTRY PROPER

EMPLOYMENT SIZE OF ESTABLISHMENTS

There were 191 establishments in 1948-49 wholly or mainly engaged in the manufacture of plastics products (not including plastics-insulated electrical cables). The industry is mainly concentrated in Sydney and Melbourne. The size of establishments, according to numbers employed, in 1948-49 was as follows—

EMPLOYMENT SIZE:	Establishments	Persons Employed
	no.	no.
Less than 4 persons	28	53
4 persons	25	100
5 to 10 persons	53	366
11 to 20 persons	30	434
21 to 50 persons	34	1,067
51 to 100 persons	11	741
More than 100 persons	10	2,020
Totals	191	4,781

In that year, 21 establishments employed nearly 58 per cent. of the total persons employed in the industry.

PROCESSES USED, COMBINATIONS OF PROCESSES, TYPES OF ACTIVITIES, TOOLMAKING

It is estimated that establishments wholly or mainly engaged in the plastics industry proper numbered about 205 in September, 1951, and manufacturing companies or businesses about 190 (one company operates six establishments, another has three, a few have two). In many instances, manufacturers use more than one process. The processes used, and their combination among manufacturers, were as follows—

PROCESSES:	Manufacturers
	no.
Compression only	62
Injection only	13
Extrusion only	3
Calendering and Spreading only	3
Laminating only	2
Casting only	1
Fabricating only (forming, blowing, drawing, etc.)	44
Compression/Injection	22
Compression/Extrusion	4
Compression/Fabricating	10
Injection/Extrusion	1
Injection/Fabricating	5
Extrusion/Fabricating	2
Compression/Injection/Extrusion	3
Compression/Injection/Fabricating	9
Compression/Extrusion/Fabricating	1
Compression/Injection/Extrusion/Flexible Casting/Dipping	1
Compression/Injection/Extrusion/Laminating/Calendering	2
Compression/Injection/Extrusion/Laminating/Fabricating	1
Compression/Injection/Extrusion/Laminating/Fabricating/Flexible Casting/Dipping	1

The industry is, of course, in continuous development, increasing the variety of combinations and altering the numbers of manufacturers using any one process or combination of processes. As can be seen from the above table, 97 of the 190 firms in this industry are engaged only in compression and/or injection moulding, while a further 44 firms are engaged only in fabricating (from semi-finished materials).

In general, the largest firms in the plastics industry in Australia are those equipped for all, or most, of the processes given above. However, though the greater number of the firms shown as operating only one or two processes are small, there are several using only the processes of compression/injection or compression/injection/extrusion which have large establishments; one such manufacturer has three large establishments. In addition, two firms engaged only in fabricating are large, although the remaining 42 in this category are small.

Many firms, particularly those engaged only in compression and/or injection moulding, do only custom work (that is, to special order); many others do some custom work in addition to producing their own brands of plastics products. These firms would normally produce a wide range of different items, although some are equipped to concentrate on the production of a specific line—for example, telephone equipment of various types. Some firms, on the other hand, specialise in one or a few specific types of product, producing only their own brand-name lines of goods and not doing any custom work. In some cases, these firms also make a similar type of article from other than plastic materials. For example, one of the largest producers of plastics buttons in Australia specialises in button making, and makes buttons of many materials—plastics, metal, textile-covered, wooden, etc.

A number of large firms, unconnected otherwise with the plastics industry, have subsidiaries or branch plants engaged in making plastics parts or components for their principal products—sometimes also doing custom work if their capacity is greater than their own requirements, sometimes making for sale plastics products quite out of their usual range when their plastics capacity is idle (for example, Company “A” below).

Practically all moulders have their own toolrooms, and make their own dies. (It has not been uncommon for toolmaking businesses and companies specialising in diemaking for plastics moulding, to themselves enter into plastics-products manufacture as a corollary.) In some cases custom moulders will be supplied with a particular die by the customer. In the manufacture of some articles, certain inserts or parts of other materials than plastics are often manufactured by the plastics manufacturer.

PROCESSES AND PRODUCTS LIMITED TO FEW MANUFACTURERS

Although compression and/or injection moulding is common to most firms in the industry, and certainly to all substantial firms, the industry can be divided into five broad groups of manufacturers largely specialising respectively in—

- Compression and injection moulding.
- Calendering and spreading of plastic coatings.
- Extrusion.
- Laminating.
- Forming from acrylic sheets.

These five fields are distinctive in that there is a considerable dissimilarity in the processes involved and that they manufacture different types of products. Generally, developments in one field do not affect the others.

Certain types of plastics products covering mainly the last four categories above, are made in Australia almost entirely by 18 manufacturers. These 18 companies include some of the largest plastics-products manufacturers in Australia, which operate a wide range of processes. Some, on the other hand, are small specialist firms. Some are mainly engaged in industries other than plastics, but produce a significant part of the total output of some type of plastics products. Some of the 18 are either themselves or through parent companies significant companies in activities other than the plastics industry. There are several large firms not included in these 18; they are mainly compression and/or injection moulders. The table below sets out the types of plastics products made by each of the 18 manufacturers, and the comment following the table briefly outlines the activities (and any prominent relationships) of each company—

PRODUCTS:	Eighteen Manufacturers																	
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
Calendered film						X		X	X			X					X	
Extruded film							X					X						
Coated fabric or paper		X		X	X			X	X			X	X	X			X	X
Laminates, fabric or paper										X	X	X					X	
Garden hose								X				X						
Water piping							X					X			X			
Extruded tubing, piping and hose otherwise . . .	X						X	X				X	X					
Large fabrications (baths, sinks, etc.) from acrylic sheet				X	X													

Company “A” operates three plants, one each at Sydney, N.S.W., Melbourne, Vic., and Adelaide, S.A., for glass-container closures required by associate companies, and engages in both proprietary and custom work of a varied nature. Processes used are compression, injection, extrusion. (A 5,000-ton compression press, the largest in Australia, is being installed at the Melbourne plant.) The company is a wholly owned subsidiary of Australian Consolidated Industries Ltd., which operates five glass-container plants in Australia (three adjacent to the three plastics-products plants) and other manufacturing companies, and also owns Company “J”. (See also “Glass and Glass Products”, Chapter 2.)

Company "B" (a proprietary business) operates one plant at Melbourne, Vic., for coating of fabric with polyvinyl-butyral (principally for bias binding for footwear) and with rubber, and for laminating of fabrics with rubber solution. The company originated as part of a waterproof-garment manufacturing company and continues to do the rubber coating of fabric for the associated company.

Company "C" (a public company) operates one plant at Brisbane, Qld., and is principally engaged in making louvre windows, semi-automatic domestic washing machines, and stoves. In addition, the company is one of the two principal fabricators in Australia of goods from acrylic sheet; it is the only manufacturer of plastics domestic baths.

Company "D" (a proprietary company) operates two plants, one each at Sydney, N.S.W., and Melbourne, Vic., for coating of fabric, impregnating of fabric, starch filling and glazing of fabric, stripe pigmenting of canvas, duck and cloth (the only such processor in Australia), waterproofing of tarpaulin cloth, and fire- and rot-proofing of fabrics.

Company "E" (a proprietary business) operates one plant at Sydney, N.S.W., producing sinks, hand-basins, refrigerator trays and fittings from acrylic sheet.

Company "F" operates two plants, one each at Sydney, N.S.W., and Melbourne, Vic., for calendering of unsupported P.V.C. sheet and film, extrusion of P.V.C. shoe randings, motor-vehicle fender-pipings, upholstery pipings, electrical tubing, P.V.C. coating and rubber coating of fabrics and felt, combining of plain and processed felt and/or fabrics, treating and forming of felt, fabrics and webbings into trimmings for motor-vehicle bodywork, cutting and slitting of plain and processed felt, dressing of fabrics by filling or impregnating and calendering and manufacture of adhesives for sale and for own use. The company is owned by Felt & Textiles of Australia Ltd., the largest organisation in Australia in wool processing, felt and carpet manufacture, and in slipper manufacture. (See Chapter 15.)

Company "G" (a public company) operates two plants, one each at Melbourne, Vic., and Adelaide, S.A., and is substantially engaged in compression and injection moulding, and extrudes tubing, industrial hose, piping, and "layflat" tubular packaging film. Both proprietary and custom work is carried on. The company is a leading manufacturer of diecastings and collapsible tubes; a metal-stamper, particularly of products for the motor-vehicle industry; and has developed a spray-irrigation system. A subsidiary company makes builders' hardware.

Company "H" operates one plant at Sydney, N.S.W., for the manufacture of P.V.C. products by extrusion, calendering and coating processes. The company is a wholly-owned subsidiary of Dunlop Rubber Australia Ltd., the largest manufacturer of rubber products in Australia. (See Chapter 8.)

Company "I" (a public company) operates one plant at Melbourne, Vic., for calendering of P.V.C. film and sheet, and coating of fabrics with nitrocellulose, P.V.C. and rubber. The company is the largest manufacturer in Australia of chemicals generally, and of "leathercloths" and slide fasteners, and is the only manufacturer of commercial explosives and sporting ammunition. The company makes P.V.C. and nitrocellulose. (See Chapter 6.)

Company "J" operates one plant at Melbourne, Vic., for plastics laminates (industrial and decorative) of fabric or paper. The company is a wholly-owned subsidiary of Australian Consolidated Industries Ltd. (See Company "A" above, also a subsidiary of A.C.I. Ltd.)

Company "K" (a proprietary company) operates one plant at Sydney, N.S.W., for manufacture of plastics laminates (particularly for electrical work), and wood laminate for process engravers' mounting board.

Company "L" operates one plant at Melbourne, Vic., for coating of nitrocellulose "leathercloth". The company is principally a tanner of upper shoe leathers, including patent, and is a subsidiary company of Tinsley-Lloyd Investments Ltd., a public company, which has another subsidiary, a large wholesale hardware and machinery merchanting company.

Company "M" (a public company) is the largest general plastics products manufacturer in Australia, and uses the processes of compression, injection, extrusion, laminating, calendering, coating, blow moulding, flexible casting, dipping, fabricating. The company has six plants, all in the metropolitan area of Melbourne, Vic., five of which are each operated by a wholly-owned subsidiary company as a specialist in a process or product. One of the plants is concerned only with the making up and insulating of electrical cables (see "Wires and Cables", Chapter 11). The company distributes its proprietary products through its own system of wholly-owned distributing companies in each State except Tasmania, which is covered from Victoria. Considerable custom work is undertaken for compression and injection moulding. Other than for insulated-cable manufacture, the company has no manufacturing activities not directly associated with the plastics industry proper.

Company "N" (a public company) operates two plants at Melbourne, Vic., and uses the processes of compression, injection, extrusion, coating, flexible moulding, and dipping. Both custom and proprietary work are undertaken. The company is among the larger of the plastics-products manufacturers in Australia, and has no manufacturing activities not directly associated with the plastics industry proper.

Company "O" (a proprietary company) operates one plant at Melbourne, Vic., for manufacture of rigid plastics water piping (of which it is the principal manufacturer in Australia), custom extrusion of rods, tubing and special sections, and knitting needle fabrication.

Company "P" (a public company) operates two plants at Sydney, N.S.W., for P.V.C. calendering and coating of fabric.

Company "Q" (a proprietary company) operates one plant at Sydney, N.S.W., for manufacture of plastics laminates and products therefrom, including gears and pinions, and is also engaged in plastics moulding, and manufacture of corrosion-resistant centrifugal pumps and pressure-leaf filters.

Company "R" (a public company) operates one plant at Melbourne, Vic., for the coating of paper with polyethylene for direct wrapping of food and for multi-wall bags used for packaging of food and hygroscopic materials. (The activity is in its early stages, and plant and production are, at mid-1952, on a semi-commercial footing.) The company is the principal manufacturer in Australia of wrapping papers and of paperboards, and is the only plastics-coater of paper in Australia. (See Chapter 4.)

PLASTICS PRODUCTS MANUFACTURE OTHER THAN IN PLASTICS INDUSTRY PROPER

The activities shown below (except that of manufacture of electrical-wiring fittings) are not included as part of the plastics industry proper in official factory statistics, and for the purpose of this study are included elsewhere with the industry of which each is a direct part. The activities are listed here to complete the description of plastics-products manufacturing in Australia provided in this Part.

Plastics-insulated Cables: Seven manufacturers, of which three are large producers. (See "Wires and Cables", Chapter 11.)

Electrical-wiring Fittings (switches, plugs, sockets, roses, plates, adaptors, and so on): Four manufacturers, mainly three of which are large producers (one more so than the other two), and one a small producer. The manufacturers make their own inserts and portion of their screw requirements. Electrical-wiring fittings are also made in small quantities as a lesser activity by several plastics-products manufacturers. (See "Fittings", Chapter 11.)

Plastics Components for Electrical and Electronic Devices, and Hardware: Some manufacturers of these products operate plastics-moulding sections to make their own requirements of plastics components. In particular, most of the large manufacturers of radio receivers make their own plastics cabinets, tuning knobs, etc., as well as plastics components for any other domestic electrical appliances made.

Artificial Teeth: Two manufacturers, both mainly engaged in dental-supply activities. In addition, many dental mechanics and some dentists also mould teeth in small numbers for their own requirements. (See "Dental Equipment and Supplies", Chapter 12.)

Part Two: Outline of Capacity of Manufacturing Activities

THE manufacture of plastics articles commenced in Australia in 1917 with moulding from phenol-formaldehyde moulding powder. The industry's growth has been linked to a great extent with expansion of usage of plastics materials as substitutes for, and in competition with, other established materials. This has, in some instances such as the manufacture of electric-light switches and connections, reached the stage where plastics are now regarded as the most suitable material. Since 1939, the industry has experienced a period of rapid development and now employs over 5,000 persons. There has been little tendency to decentralisation and the industry is largely concentrated in Sydney and Melbourne, although factories are operating in all States.

RAW MATERIALS

In most cases, manufacturers secure their materials in compounded form, that is, the resin is already mixed with modifying materials such as fillers, plasticisers, pigments, catalysts, stabilisers and lubricants, by which the desired properties of the finished plastics articles are secured. However, some of the larger moulders compound some of their materials. The principal thermosetting materials used are phenol-formaldehyde, urea-formaldehyde and melamine-formaldehyde. The principal thermoplastic materials used are cellulose acetate, cellulose nitrate, cellulose acetate butyrate, polystyrene, polyethylene, polymethyl methacrylate, polyvinyl chloride and related co-polymers.

A feature of the development of the industry during the last ten years has been the expansion in injection moulding, calendering and extrusion capacity, thus increasing considerably the demand for thermoplastic materials.

The Australian chemical industry manufactures a wide range of plastics materials and is expanding its productive capacity. However, to cope with the rapid postwar increase in demand for plastics products, considerable quantities of plastics raw materials have been imported. In 1948-49 and 1949-50 imports, in broad groupings, were—

IMPORTS:	1948-49	1949-50
Resins and compounded materials—	tons	tons
Thermosetting types	1,021.1	833.2
Thermoplastic types	1,790.9	2,727.8
Casein and other protein types ..	13.8	3.4
Basic forms (block, sheet, rod, etc.)	934.5	938.2

Further details of Australian production and imports of plastics materials are given in Chapter 6.

Probable consumption of plastic resins and moulding powders is estimated for 1951-52 as follows—

PROBABLE CONSUMPTION, 1951-52:

	tons
Phenol formaldehyde moulding powders	3,500 to 4,500
Urea formaldehyde moulding powders	1,500
Polyvinyl chloride	2,500
Cellulose acetate and cellulose acetate butyrate	800
Polystyrene	1,500
Melamine formaldehyde moulding powders	250

Polyethylene will be used in large quantities as and when it becomes available, although consumption at present is less than 100 tons a year. Acrylic resins, including polymethyl methacrylate, are used to produce a number of plastics articles, though total usage is much smaller than the tonnages given above for other resins and powders. In 1952 the demand for plastics products, and consequently for resins and moulding powders, has fallen considerably below the 1951 level. It is expected that the overall consumption of resins and moulding powders in 1952-53 will be less than in 1951-52.

PLASTIC PRODUCTS AND PROCESSES

The list of plastics products set out below is indicative of the wide scope of such manufacturing in Australia. Classification of products according to materials used or manufacturing processes is not practicable as articles for similar purposes are often manufactured from different types of resins or by different processes. Most of the plastics items listed are competitive in price with existing products manufactured from wood, metal, rubber, fabric, glass, etc.

PERSONAL ACCESSORIES, including buttons, buckles, combs, costume jewellery and novelties, hairclips and ornaments, beads, ear-rings, necklets, cosmetic containers, powder compacts, cigarette cases, cigarette holders, tobacco pouches, brushware (tooth, nail, hair, clothes), sunglasses, clothing (aprons, bibs, raincoats, etc.), knitting needles, belts, braces, shirt and collar-studs.

TOYS, GAMES AND SPORTING GOODS, including balls, dolls, nursery toys, toy furniture, tea-

sets, money boxes, recorder flutes, whistles, chessmen, table-tennis balls, lawn bowls, fishing reels, dice, counters, tennis racquet laminates, etc.

DOMESTIC ARTICLES, including bowls and basins, beakers, cups, plates, egg cups, salt and pepper shakers, spoons, other tableware, canisters, kitchen utensils, draining racks (of wire, plastics coated by dipping), lunch boxes, trays, kitchen cabinets, refrigerator boxes, ice-cube trays, household stools, coffee tables, clothes pegs, clothes hangers, ash-trays, smoking stands, lamp shades, statuary and ornaments, shower curtains, tablecloths, shelf coverings, garden hose.

BUILDING MATERIALS AND FITTINGS, including sinks, wash basins, baths, closet seats, chair seats, table and bench tops, wall-tiles, wall-boards, wall panelling, furniture panels, slats for venetian blinds, knobs and handles, builders' hardware, bathroom fittings, soap holders.

CONTAINERS, including caps and closures for glass and metal containers; food containers; acid containers; perfume bottles; collapsible tubes; transparent packages, wrappings, tape, plain or decorated;

protective anti-corrosive linings for tanks, etc., liquid envelope protective coatings for machinery and parts.

ELECTRICAL AND ELECTRONIC EQUIPMENT AND PARTS, including plugs, switches, connectors, adaptors, fuse boxes; switchboard bases; insulating material, tubing, etc., coated wires and cables; radio parts and cabinets; lighting fixtures and fittings, bed and table lamps, standard lamps, torch cases; battery parts; telephone handsets, mouth and ear pieces; acoustical equipment including hearing aids; vacuum-cleaner parts, floor-polisher parts.

COMPONENTS AND MATERIALS FOR OTHER INDUSTRIES, including handles for tools, etc.; fittings for aluminium hollow-ware; washers, rings, etc.; camera housings and viewfinders, clock cases, etc.; brush backs and handles; umbrella handles and ferrules; handbag frames and materials; show materials; body and cups for vacuum flasks; unbreakable watch-crystals; watch straps; refrigerator components and accessories; automotive and aircraft parts and accessories; artificial teeth; coated or impregnated materials; laminated materials—sheet, tube, rod; sheet plastics; extruded sections, tubes, rods, etc.

EQUIPMENT FOR OTHER INDUSTRIES, including machine parts, gears, bearings, rollers, pulleys, bobbins, spools, machine guards, oil cans; acid pumps, anti-corrosive piping, fittings and equipment, and other anti-corrosive industrial equipment; water piping; industrial helmets, hoods, shields and goggles; surgical and pharmaceutical equipment and supplies; optical equipment; advertising items, cases and stands (display and fixture); letters and figures; rulers, inkwells, office equipment.

The above items are made, variously, by the methods of plastics production discussed below.

Plastics **COMPRESSION MOULDING** is the oldest established method of plastics products manufacture in Australia. It is estimated that there are about 1,250 compression moulding presses in Australia, ranging from many of 25-tons to one of 5,000-tons pressure (this is not yet completely installed). The most popular size range is between 40-tons, costing about £950, and 300-tons, costing about £2,750. The majority of compression presses have been manufactured in Australia. Although further development in the use of compression moulding is probable, the rate of future expansion is likely to be less rapid than in the past. Articles such as wireless cabinets, toys, cigarette cases, kitchenware, and electrical fittings are manufactured by this process.

There has been particularly rapid development in the use of **INJECTION MOULDING** in the post-war period. It is estimated that there are now approximately 190 to 210 injection moulding machines in use, with a total injection capacity of between 1,000 and 1,200 ounces. The 4-ounce machine, costing about £3,500, is most common, though there are a number of 8-ounce machines and a few 22-ounce machines also in use. Injection presses are manufactured by one Australian firm, though American-made machines are the most popular. Dollar shortages and devaluation, which raised prices considerably, now limit purchases of American machines. Many

articles produced by this method, such as toys, cigarette and jewellery cases, kitchenware, etc., may be made also by compression moulding.

LAMINATING of plastics-impregnated paper and cloth into sheet, rod and tube form, has been practised since 1935. From the laminated material are cut such items as gears, bearings, machine parts, electrical switchboards, panels for furniture, etc. Production has increased considerably in recent years, particularly of decorative laminates in sheet form for furniture and panelling, etc., and for industrial and electronic uses.

Plastics **EXTRUSION** is a relatively recent development in the Australian industry. Plastics garden hose, water pipes, insulation for wires and cables, etc., are examples of products made by this process. Extruders have been obtained mainly from the United Kingdom and U.S.A. Some Australian firms have built successful extruders for their own use. Extrusion of polyethylene film was recently begun by two firms—"layflat" tubing up to 22 ins. wide, film and semi-rigid sheet are made. Semi-rigid cellulose acetate sheet is also made by the extrusion method.

The production of plastics film by **CALENDERING** has increased rapidly in recent years. In Australia, P.V.C. film is the principal product, and is used mainly for household articles such as shower curtains, tablecloths, shelf coverings, etc., and for clothing such as aprons, raincoats, etc. There are few calendering machines as yet in operation. Most of these have been imported from the United Kingdom.

The **COATING** of textiles is carried out with pastes or solutions of resins, mainly polyvinyl chloride. The coating operation consists of impregnation, spreading or calendering, according to requirements. Plastics-coated textiles are used in the production of coverings for furniture or automobile seats, raincoats, suitcases, handbags, etc. Plastics-coated paper is used for food packaging, bookbinding, blind holland, etc., but at present the only plastics-coated paper produced in Australia is a polyethylene-coated paper for packaging of food and hygroscopic materials.

Other processes used in fabricating plastic articles, but to a somewhat lesser extent, include **FLEXIBLE CASTING** (slush moulding) and **PASTE DIPPING** of domestic and industrial articles, using a vinyl-base material; **HOT DIPPING**, using an ethyl cellulose material, for protective industrial coatings; **BLOW MOULDING** of cellulose acetate and cellulose acetate butyrate film for packaging shapes; **FORMING** from acrylic sheets of such articles as sinks, hand basins, baths, lighting ware, signs and display stands, etc.; **GLAZING** in both plain and corrugated form; and **CASTING** of phenolic resins into rods and various shapes for either further fabrication or direct use (e.g., umbrella handles, statuary).

AUSTRALIAN PRODUCTION

The Australian plastics products industry has sufficient capacity to supply substantially all of Australia's requirements of a large range of plastics products. However, because of the high costs involved in the preparation of dies and the relatively limited size of the Australian market, imports from large overseas producers of some goods are considerably cheaper than similar Australian products. This applies parti-

cularly to such items as toys, novelty articles, jewellery and similar products, where the market depends largely on a wide variety of choice. So, although the range of Australian production in these fields is extensive and should continue to expand, it is probable that imports will continue to supply a proportion of the local demand.

PLASTICS PRODUCTS

Australian production of various types of plastics products, in 1948-49 and 1949-50, are set out in the following table—

PRODUCTION:	1948-49	1949-50
	£	£
Blanks—Tooth brush	7,510	(a)
Other toilet brush	11,307	(a)
Bottle tops and closures	173,953	172,557
Buckles	27,761	42,795
Buttons	562,713	637,176
Cigarette cases, compacts, vanity cases, etc.	9,847	(a)
Costume jewellery	50,345	34,932
Electrical goods, switchgear, etc.	802,730	894,828
Garden hose	(a)	(a)
Gears, bearings and other machine parts	227,199	230,152
Hollow ware (boxes, cans, etc.)	66,170	101,368
Radio cabinets	114,484	139,306
Lamp shades and reflectors	14,293	30,695
Sheets, plates, blocks, rods, tubes, blanks, and other unfinished forms	231,835	218,903
Sinks	(a)	(a)
Slide fasteners	(a)	(a)
Store fronts, table tops, etc.	(a)	(a)
Tableware (cups, saucers, plates, trays, salt and pepper shakers, etc.)	332,530	(a)
Toys (including dolls)	435,159	611,134
Wall tiles	(a)	(b) 22,097

(a) Not available for publication.

(b) 11,569 square yards.

In 1948-49, 67,714 gross of plastics clothes pegs were made, and in 1949-50, 77,606 gross. The number of plastics radio cabinets made totalled 181,942 in 1948-49 and 204,999 in 1949-50. The above table sets out only the principal types of goods manufactured. Total value of output of all plastics articles produced in Australia is estimated to be about £10 million a year. The industry continues to expand and to widen its range of products and processes.

Statistics of imports of plastics products as such are limited, as in most cases they are included with similar articles made from other materials. However, it is estimated that, in total, imports would supply less than 10 per cent. of the total value of plastics products sold on the Australian market.

Some further information on production of, and demand for, various types of plastics articles is given below.

Electrical Goods

This group covers only those electrical items which may be made of plastics and includes telephonic and telegraphic apparatus; electrical accessories; and torch cases, portable tools and appliances, and small household electrical and mechanical appliances. The use of plastics materials in the manufacture of these types of goods has increased rapidly since the war, and it is estimated that some 40 per cent. (by value) of all such electrical goods would be made from plastics materials.

Australian manufacturers have capacity to produce all the plastics parts for telephones that are required, but a shortage of assembling capacity is keeping the import of complete assembled telephones at an appreciable level. In 1949-50 imports of telephones and parts thereof were valued at £911,791, of which about 30 per cent. is estimated to be the value of plastics components.

The demand for electrical accessories is predominantly for goods of plastics composition. The manufacture of electrical accessories is well established in Australia; the necessary moulding powders, equipment and technical

knowledge are available. Over 90 per cent. of electrical accessories such as flush plates, connections, and ceiling roses are manufactured locally; the balance consists mainly of a small quantity of special types not made in Australia. Imports in 1949-50 of all types of flush plates, connectors, ceiling roses, moulded lampholders, adapters, wall sockets, wall plugs and wall plug tops were valued at £60,172. Before the war, appreciable quantities of these types of goods were exported from Australia to New Zealand, South Africa and the Near East. During and since the war, however, exports of plastics household electrical components have been prohibited, except for certain quantities permitted for export to New Zealand, the Pacific Islands and South Africa.

Although it is estimated that about 30 per cent. in value of component parts of torch cases, portable tools and appliances and small household and electrical and mechanical appliances can be manufactured from plastics compounds, only a part of this potential is being realised at present. Some further expansion of the use of plastics in these products is possible.

Toys

Australian manufacturers make an extensive range of plastics toys. However, because of the high cost of dies and the relatively limited home market, Australian manufacturers, in most cases, must confine their activities to the simpler types of goods. Overseas manufacturers, with much larger markets over which to spread their tooling costs, can undercut the Australian manufacturer in the more intricate types of toys. The re-entry of Japan into the toy markets is causing considerable concern to Australian manufacturers; and the full strength of this competition has not yet been felt. The estimated value of imports of plastics toys in 1949-50 was about £130,000, as compared with production by Australian plastics manufacturers valued at £611,000.

Combs

The Australian market for plastics combs has to date been supplied mainly by imports. Manufacturers in Australia are meeting strong competition from imports, and some, in fact, have incurred considerable losses by tooling up for production and being unable to sell in competition with imported goods. Imports of toilet combs of all types (about 90 per cent. are estimated to be of plastics) in 1949-50 were valued at £100,167.

Cigarette, Toilet, Jewellery and similar Cases

The supply of plastics cases generally is meeting demand, but being luxury goods and subject to the dictates of fashion, demand for plastics in preference to other materials tends to fluctuate. Australian production of these types of plastics cases has declined considerably in recent years, value of output in 1948-49 being only £9,847 compared with £40,773 in 1946-47 and £19,303 in 1947-48.

Buckles, Clasps and Costume Jewellery

As with cigarette and other cases, the demand for this type of product fluctuates considerably with fashions. Australian production in 1949-50 showed a considerable decline in the value of costume jewellery from the previous year, although the value of buckles made increased by 65 per cent.

Buttons

The manufacture of plastics buttons is firmly established in Australia, and, apart from some high-priced fashion goods, Australian manufacturers have always supplied the bulk of the home market. Pre-war, most of the buttons were made from casein, but since the war casein has been replaced with synthetic plastics. About 60 per cent. of the total demand is now for synthetic plastics buttons. Plastics buttons is one of the largest items, in value, of products made by the Australian plastics industry. Value of imports in 1949-50 was estimated at about £70,000, compared with Australian production valued at £637,176.

Laminated Materials

These materials are produced in the form of sheets, blocks, rods, strips, tubes or other shapes, from which are manufactured gears, bearings, machine parts and other specialised products for the railways, communications, general transport, aircraft, steel, marine, chemical and general engineering industries. Two companies in Australia specialise in this type of work, and a third produces laminates in addition to other products. Australian production supplies most of the local market requirements, imports of articles of laminated plastics in 1949-50 being valued at £42,004, compared with Australian production of plastics gears, bearings and other machine parts valued at £230,152. Gradual but steady expansion of demand can be expected in this field. Present capacity is sufficient to meet demand, and capacity can be readily expanded.

Closures

The demand for plastics closures, such as bottle and jar tops, has increased greatly since before the war. Australian manufacturers supply most of the home market, and capacity can be readily expanded. Small quantities of plastics closures are exported.

Radio Cabinets

The manufacture of plastics radio cabinets in Australia, which is carried out by custom moulders and by radio-receiver manufacturers, is a substantial activity, and supplies all of Australian requirements. Output in 1949-50 totalled 204,999 cabinets. Imports and exports are negligible.

Transparent Cellulose Film

No regenerated cellulose film (better known by a trade name "Cellophane") is made in Australia at present, although one overseas firm is contemplating its manufacture in Australia. Imports in 1949-50 were 17,115 cwt. (Further comment on possibilities of manufacture in Australia is given in Chapter 4, "Pulp, Paper, Paperboard".)

Furniture, Sinks, Basins, Baths, etc.

The use of laminated plastics sheets in the manufacture of furniture, particularly for kitchens and cafes, and for wall panelling, etc. has expanded considerably in the post-war years. Australian production meets most of these requirements.

Sinks, basins and baths, formed from acrylic sheet, are made in limited quantities, but these are somewhat higher in price than the enamelled cast-iron or ceramic types and are not as yet in very wide demand.

Plastics-coated Textiles

The manufacture of plastics-coated fabrics (apart from nitrocellulose leathercloth) is a fairly new development in the Australian industry. Such fabrics are used in the manufacture of raincoats, suitcases, for automobile and furniture upholstery, linings for non-shrink shirt collars, book binding, etc. Australian production of plastics-coated fabrics, particularly leathercloth, is substantial, but significant quantities of impregnated or coated fabrics are imported. Some import figures for 1949-50 are given below, although these include fabrics treated with other materials than plastics—

IMPORTS:		1949-50	
		sq. yds.	£
Waterproofed piecegoods, prepared with rubber, oil, celluloid or nitrocellulose—			
Bookbinders' cloth prepared with nitrocellulose	20,592		4,609
Leathercloth	997,975		291,780
Oil baize and similar fabrics	1,035,652		136,981
Other—			
Wool	10,291		7,052
Cotton	871,342		189,992
Silk	7,857		2,172
Rayon	40,019		9,778
Other	267,494		57,876

A similar type of product, as yet not produced in Australia, is plastics-coated paper for use as bookbindings, substitute for oil baize, blind holland, etc. The coating of paper with polyethylene, for use mainly in food packaging, has been recently commenced in Australia by one company. At least two other plastics manufacturers are also considering the manufacture of plastics-coated paper.

Hose and Piping

Production of plastics garden hose is estimated to be about 8 million feet a year. Australian manufacturers supply practically all of the local market requirements. Plastics industrial hose is being used increasingly, particularly in the food-processing and chemical industries, in cordial manufacture and for piping beer.

Rigid plastics piping is being used for water reticulation (its use has been approved by water authorities in two capital cities). Although it is about 60 per cent. more expensive initially than galvanised-iron piping, the cost of installation, particularly for irrigation purposes, of rigid plastics piping is much lower because of lighter weight, longer lengths without joints, and less expensive methods and greater ease of joining the lengths. Production capacity is in excess of present output because manufacturers are short of suitable raw materials.

Plastics-insulated Wire and Cables

There is a steadily increasing demand for plastics-insulated wire and cables. Polyvinyl chloride is the principal material used, but the use of polyethylene is increasing. Except for heavy cables and a few special types of insulated wire which are imported, the bulk of plastics-insulated wire and cable consumed in Australia is manufactured in Australia. At present, supply is meeting demand, but a further considerable expansion can be expected in this field. (See also "Wires and Cables", Chapter 11.)

In addition to the above, there are many new fields of plastics production being developed, some of which may have considerable possibilities, e.g., the manufacture of plastics floor coverings and roofing materials.

Part Three: Basic Statistics

COMPARATIVE STATISTICS, 1938-39/1949-50

NUMBER OF ESTABLISHMENTS AT 1938-39 AND 1949-50

NUMBER OF EMPLOYEES AT 1938-39, 1949-50, JUNE 1950, SEPTEMBER 1951

Activity (Statistical Sub-class used by Commonwealth Statistician, 1949-50)	Establishments		Employees			
	1938-39	1949-50	1938-39	1949-50	June 1950 (a)	Sept. 1951 (a)
Plastics Moulding and Products (b)	no. (c)	no. 198	no. (c)	no. 5,169	no. 4,976	no. (d)4,500
Totals (c)	(c)	198	(c)	5,169	4,976	(d)4,500

STATISTICAL SUMMARY, 1949-50

EMPLOYMENT, MALE AND FEMALE

SALARIES AND WAGES PAID, IN TOTAL AND PER PERSON ENGAGED

VALUE OF PRODUCTION

VALUE OF MATERIALS, POWER, FUEL, REPAIRS, etc.

VALUE OF OUTPUT

See Explanations,
Appendix IV

Activity (Statistical Sub-class used by Commonwealth Statistician, 1949-50)	Employment			Salaries and Wages Paid		Value of Pro- duction	Value of Materials, Fuel, etc. Used	Value of Output
	Males	Females	Persons	Total	Per Person Engaged			
Plastics Moulding and Products (b) ..	no. 3,393	no. 1,776	no. 5,169	£'000 2,189	£ 423	£'000 3,420	£'000 3,394	£'000 6,814
Totals (c)	3,393	1,776	5,169	2,189	423	3,420	3,394	6,814

Explanatory Footnotes to Both Tables

- (a) These employment figures are taken from monthly payroll-tax returns and differ slightly from the other employment figures, which are supplied on annual factory returns.
- (b) Includes all types of fabrication of synthetic-plastics materials—moulding, extrusion, casting, dipping, forming, spreading, assembly, etc. However, the activity of nitrocellulose coating of fabric for "leathercloth", carried on at two establishments in Victoria, is included (together with linoleum manufacture) in a statistics sub-class entitled "Linoleum, Leathercloth, Oilcloth, etc."; the activity of coating of fabrics with plastics materials, where carried on as the sole or main activity, is dealt with in this study in Chapter 17, "Products of Textiles and/or Wastes, Cordage, Hair, Felt, Not Elsewhere Included".
- (c) At 1938-39 a sub-class entitled "Celluloid and Similar Compositions" was in existence, but the statistics of the sub-class were grouped into one set of statistics with the statistics of two other sub-classes—"Linoleum, Leathercloth, Oilcloth, etc." and "Bone, Horn, Ivory and Tortoiseshell". Separate statistics are therefore not available.
- (d) Estimate only. The employment statistics for September 1951 have grouped into one set of statistics the employment statistics for three sub-classes—"Linoleum, Leathercloth, Oilcloth, etc.", "Bone, Horn, Ivory and Shell" and "Plastics Moulding and Products".
- (e) Consideration and comparison of totals must take into account the effects stated in footnotes explaining the composition of the sub-class and figure units.

Chapter 8 :

RUBBER PRODUCTS

RECONDITIONING OF TYRES

Part One: Structure of Established Manufacturing Activities

MANUFACTURING of rubber products and tyre-repair materials, and the reconditioning of tyres are established in Australia in an overlapping pattern of activities by three main companies, five lesser companies and many smaller companies, as follows—

RUBBER PRODUCTS

There are about 78 establishments wholly or mainly engaged in making rubber products (not including tyre repairing). Fifteen of these establishments (some of which are units of a company with several establishments), in 1948-49, each employed more than 100 persons, and in aggregate employed 8,923 persons out of an industry total of 10,077; of the remaining 62 establishments, 35 each employed up to 10 persons, 9 each from 11 to 20 persons, 12 each from 21 to 50 persons, and 6 each from 50 to 100 persons. The structure of the principal rubber-products companies, as set out below, is indicative of the present position.

THREE MAIN COMPANIES. unassociated with one another, together employ at 24 factories about 80 per cent. of all persons employed in manufacture of rubber products (not including reconditioned tyres). Details of establishments and products of the three companies are as follows—

Dunlop Rubber Australia Ltd., with seven specialist manufacturing subsidiary companies, employs about 5,000 persons in twenty factories (not all rubber-products factories) located in five States. This company is associated with a leading U.K. rubber-products company of similar name.

The parent company has two large factories, one at Sydney and one at Melbourne, concentrating on production of tyres and tubes, but also making a range of other (mainly heavy) rubber products. Two smaller factories make general mechanical rubber products, one at Adelaide and one at Perth. One decentralised factory in N.S.W. makes footwear. Three decentralised factories in Victoria make vee-transmission belts, golf-ball winding, and cut-rubber thread, respectively. A large factory is to be erected near Melbourne to specialise in making the company's range of metal and rubber components and assemblies for aircraft.

The latex-foam subsidiary has four urban factories, two at Melbourne, one at Sydney and one at Brisbane.

The flooring subsidiary (mastic industrial and underlay flooring, asbestos-base floor-tiles) has one factory, at Melbourne.

The wet-battery subsidiary (batteries and cases) operates two factories, one at Melbourne and one at Sydney.

The plastics subsidiary (making P.V.C. products) operates one factory at Sydney.

The clothing subsidiary (which makes waterproofed, rubber and chemical, and non-proofed sports clothing) has two factories in N.S.W., one decentralised and one at Sydney.

The sporting-goods subsidiary (racquets) operates one factory at Sydney. This company also distributes golf clubs made in Australia by another manufacturer.

The tennis-gut subsidiary has one factory at Sydney.

PRODUCTS made include—

Aircraft metal and rubber components and assemblies, including wheels, brakes, hose. Automotive accessories.

Balls—golf, play, squash, tennis, etc.

Batteries and cases. Belting—flat-transmission (and portable vulcanising units), link and endless vee-transmission, conveyor, elevator.

Blackboard material. Blankets for printing presses.

Cushioning (latex-foam), including mattresses, theatre and automotive seating, carpet underlay (both latex and blown-sponge).

Diaphragm material, diaphragms. Domestic rubber goods of comprehensive variety.

Flooring—runner, for domestic and public buildings, etc.; mastic for industrial floors and for underlay; asbestos-base floor-tiles.

Rubber and rubber/canvas footwear of wide variety. Footwear-repair soling material and adhesive, ready to apply. Rubber heels.

Garments—waterproofed with rubber or chemical-treatment, non-proofed sports clothing. Gauge-glass rings. Gloves, (rubber only).

Grommets. Gut material, for sports racquets.

Hose, garden and industrial, including all-rubber, canvas-reinforced, polyvinyl-chloride (P.V.C.), wire-reinforced or "armoured". Hospital rubber goods.

Industrial rubber products of comprehensive variety. Insertions. Insulation-tape.

Linings, anti-corrosion, chute, etc.

Mechanical rubber-goods of comprehensive variety. Milker rubberware.

Packing. Pram tyreing. Plugs, domestic and industrial. P.V.C.-calendered film and sheeting, and P.V.C. extrusions.

Racquets for tennis, badminton, squash. Reclaiming of rubber.

Rings. Repair outfits—motor, motor-cycle, cycle.

Sheeting, including ship-refrigerator. Solutions and rubber-based cements. Sporting goods. Stationery rubber goods. Stoppers.

Strip, including portlight and chum. Surgical goods. Syringes.

Thread, cut. Tubing and tubes, commercial and industrial. Tyres and tubes—aircraft, car, truck, cycle, earth-moving equipment, tractor and implement. Tyre-retreading and tyre-repair materials.

Washers. Waterproof sheeting and garments. Wheels—solid, cushion, pneumatic, for industrial trucks, barrows, etc.

Goodyear Tyre and Rubber Co. (Aust.) Ltd. operates a large factory at Sydney, specialising in a limited range of products, particularly tyres and tubes and belting. This company is a subsidiary of a leading rubber-products company of the U.S.A.

PRODUCTS made—

Tyres and tubes—car, motorcycle, truck, aircraft, tractor, grader, implement, earthmover and industrial (including solid). Tyre-retreading and tyre-repair material. Tyre accessories.
 Belting—transmission, flat and vee-endless; conveyor; elevator.
 Hose—industrial and garden, of wide variety.
 Mats and matting.
 Miscellaneous moulded and extruded rubber products.
 Packings, rubber.
 Reclaiming of rubber.
 Rubber-to-metal products.
 Sheet rubber.
 Soling material for footwear.

Olympic Tyre and Rubber Co. Ltd. operates one large factory and one small factory at Melbourne, and one large factory at Brisbane, specialising in a limited range of products, particularly tyres and tubes. (The Brisbane factory began production early in 1951.)

PRODUCTS made—

Tyres and tubes—car, truck, aircraft, tractor (certain sizes only), implement and cycle. Tyre-retreading and tyre-repair materials.
 Flooring (runner).
 Garden hose (canvas-reinforced).
 Processed rubber (for use by an associate company making electric cables and operating a rubber reclaim plant).

FIVE LESSER COMPANIES make a wide variety of rubber products—

Advanx Tyre and Rubber Co. Pty. Ltd. operates one large factory at Sydney, making machinery and rubber materials for retreading and repair of tyres, rubber footwear, waterproof and spread materials, hot-water bottles, gaskets and toys.

Hardie Rubber Co. Ltd. operates two medium-sized factories and one smaller factory, at Sydney, and makes car, truck and tractor tyres and tubes, tyre retreading and tyre-repair material, footwear, moulded goods, milker rubberware, garden, industrial and mechanical hose, waterproof garments (including rubber spreading of fabric) and motor accessories.

Kenworth Rubber Ltd. has two subsidiary companies, and operates one medium-size and two smaller factories (one a reclaim factory) at Melbourne, and two smaller decentralised factories in Victoria. These factories make soles and heels, clothes-pegs, industrial truck wheels (solid), flooring (runner), pram-tyreing, automotive weather-strips, milkerware, all-rubber garden-hose, canvas-reinforced packing, rings, playballs, extruded and mandrel mechanical goods and rubbered rollers for industry. Latex and fibred-leather shoe stiffener, insoles, etc. are made by one subsidiary at one factory. Anti-corrosion linings and coatings of natural and synthetic rubbers and of plastic are made by the other subsidiary at one factory.

S.A. Rubber Mills Ltd. operates one large factory, at Adelaide, making, in particular, a very wide range of rubber products for the automotive, refrigerator, washing-machine and aircraft industries (to which it is one of the principal suppliers of rubber products), rubber products for other industries, and also rubber flooring, garden hose and minor products.

North Australian Rubber Mills Ltd. ("Narm") operates one large factory at Brisbane, making rubber footwear, flooring, flat-transmission, conveyor and elevator belting, cycle tyres and tubes and moulded products.

SMALLER COMPANIES, operating about fifty establishments, mainly at Sydney and Melbourne, are wholly or mainly engaged in the manufacture of rubber products of a comprehensive variety. The following are selections to illustrate the activities of the larger companies (each with one establishment) of the smaller-companies' group—

One company manufactures cycle tyres and tubes, aircraft components, cushion tyres, pram tyreing, hospital sheeting, mechanical goods, repair outfits for motor, motor-cycle and cycle tubes.

One company specialises in the manufacture of rubber/canvas belting—flat-transmission, vee (adjustable link-type, canvas reinforced), elevator, conveyor. This company also makes leather belting, mechanical leathers and textile leathers.

One company produces air-cushions, and other moulded goods such as hot-water bags, soles and heels, surgical and household goods, prophylactics and druggists' sundries.

One company specialises in aircraft components, footwear and rubber proofing.

One company produces a specialised range of moulded products, including aircraft components.

One company makes golf and tennis balls, football and basketball bladders, and industrial rubber goods of wide range.

One company specialises in the production of a wide range of automotive parts of rubber and of rubber-bonded to metal—the latter process is operated under licence from a large U.S. rubber-products company.

One company specialises in latex-foam fillings for domestic and hospital mattresses, car and theatre seating, clothing accessories.

One company specialises in the manufacture of tennis-balls and play-balls.

(Two manufacturers of sporting goods, the largest companies of their type in Australia, each make tennis-balls and golf-balls as part of their general sporting-goods manufacture. See also Chapter 12.)

TYRE RETREADING AND REPAIRING

Re-conditioning of tyres by—	{	There are more than 300 establishments wholly or mainly engaged in tyre retreading and repairing, employing nearly 2,000 persons. The activity is widely spread throughout the Commonwealth, mainly as a specialised service carried on in small establishments at district centres, with garages acting as agents or depots. Fewer than 8 establishments employ more than 20 persons each. Retreading services usually also repair tyres; many garages repair tyres, but few provide a retreading service on the premises. Two of the three major rubber-products companies have interests or indirect connection with tyre-retreading "chains" and individual establishments, and two of the lesser companies directly conduct a metropolitan retreading and repair service.
Retreading; recapping.		
Vulcanising/repairing.		

Part Two: Output of Capacity of Manufacturing Activities

THE rubber manufacturing industry in Australia is a substantial one, and produces many essential products. On the basis of quantities of rubber consumed in manufacturing, about 85 per cent. of the industry is controlled by three large companies. All others are small in comparison. Competition within the industry has been very keen in the past, and will no doubt return to its former keenness when present shortages are overcome.

It is estimated that the present tonnage output of the industry is about 58 per cent. greater than pre-war. However, demand for rubber products has increased even more, and local production in some lines is insufficient to meet Australian requirements. (Significant exceptions are garden hose and bicycle tyres and tubes.) Capacity of the industry is appreciably higher than the present situation might indi-

cate. Shortages of labour and electric power (particularly in Sydney) are limiting the output of the industry. Modernisation and rationalisation in the older established factories is increasing the effectiveness of labour; and the establishment of factories, or branch plants, particularly for specialist activities, in extra-metropolitan areas is improving the availability of labour.

THE RUBBER-PRODUCTS INDUSTRY

MATERIALS USED

The rubber products industry relies substantially on imports for supplies of raw materials.

All crude rubber is imported, mainly from Malaya and Indonesia. Small quantities are also being obtained from the Australian territory of New Guinea. Limited amounts of synthetic rubber (special-purpose types only) are imported. The quantity of rubber used by the industry in 1950 totalled 42,545 tons, including 34,152 tons of crude and latex, 220 tons of synthetic and 8,173 tons of reclaim. This compares with a total usage of approximately 20,000 tons of all types of rubber in 1938-39. Current consumption is estimated at between 10 per cent. and 15 per cent. higher than the 1950 figure.

Carbon black, which is not made in Australia, is imported mainly from the U.S.A. Imports in 1949-50 were about 7,600 tons, and in

1950-51 about 15,000 tons, about 90 per cent. of which would be used by the rubber industry.

Cotton tyre-cord is made in Australia, but not at present in sufficient quantities. Output in 1950-51 was about 5 million lbs.; imports were valued at about £1.5 million. No rayon tyre-cord is made in Australia and all requirements must be imported, mainly from North America. Imports in 1949-50 totalled 4.3 million lbs. and 4.4 million lbs. in 1950-51. Courtaulds Ltd. of England are setting up a factory in Australia to manufacture 6 million lbs. a year of rayon tyre-cord from the dissolving-pulp stage, and expect to be in production by 1953.

Apart from these items, the remaining raw materials such as fillers, accelerators, anti-oxidants, etc., are available largely from Australian sources.

TYRES AND TUBES

The manufacture of tyres and tubes accounts for about 80 per cent. of all rubber consumed in Australia. There are over 1.5 million motor vehicles and motor cycles on the roads in Australia, and in 1950-51 205,604 new motor vehicles and 27,150 new motor cycles were registered. There are more than 120,000 tractors on Australian farms. In 1950-51 about 27,000 new tractors were put into use. Production of tyres and tubes in Australia until recently (excluding bicycle tyres and tubes) was meeting approximately 85 per cent. of Australian demand. The deficiency was being made up as far as possible by imports, principally from the United Kingdom, in the form of tyres as original equipment included with motor vehicle and chassis imports. Motor-cycle tyres and tubes were imported in large numbers (with remission of import duty) because the tyre makers in Australia were concentrating on car and truck tyres and tubes.

The industry is not at present (mid-1952) working at capacity levels because reduced production is adequate to a demand that is levelling out.

Australian production of TYRES for CARS, TRUCKS, TRACTORS, GRADERS, etc., and AIRCRAFT in 1948-49 and 1949-50 was—

PRODUCTION:	1948-49	1949-50
	no.	no.
Motor-cycle, car and utility ..	1,229,922	1,621,560
Truck ..	413,225	491,240
Tractor, grader, earthmover, etc.	85,262	102,682
Aero ..	2,086	2,257
Total ..	1,730,495	2,217,739

Total output in 1950-51 was 2,241,000, and currently is at a level approaching 2.5 million tyres a year.

The value of tyres and tubes imported increased from £1.8 million in 1948-49 (compared with local production valued at nearly £10 millions) to £5.2 millions in 1949-50 and £5.1 millions in 1950-51. Export of tyres and tubes from Australia is prohibited except to supply the domestic requirements of Australian mandated territories.

The production of BICYCLE TYRES in Australia is fully adequate to meet local demand and, in fact, is sufficient to provide a small exportable surplus. Production over the last

three years has been: 1948-49, 1,053,000 tyres; 1949-50, 866,000 tyres; 1950-51, 1,071,000 tyres.

Apart from tyres and tubes, there is a strong demand for a wide variety of rubber products,

which may be generally classified into two broad categories, industrial or mechanical goods on the one hand, and miscellaneous products on the other.

INDUSTRIAL OR MECHANICAL RUBBER GOODS

The use of RUBBER INDUSTRIAL HOSE is increasing rapidly. Principal types are welding, air, water, oil pump, spray, air-drill, steam, petrol, suction, sanitary, acid-conducting, sand-blast, distillers, wine-suction, and cable trailing hose. Production in 1948-49 was approximately 8 million feet, and is at about the same level now. Demand is barely being met, but imports are negligible. (Industrial hose is not separately specified in statistics; imports of all types of rubber hose in 1948-49 were 256,411 lbs., and in 1949-50 242,448 lbs.)

The production of RUBBER BELTING in Australia is generally adequate to meet the demand. Production of conveyor and elevator belting (most of the large items are made-to-order) is lagging somewhat behind demand, but output of V-belts, flat transmission belting and fan belts for motor vehicles is adequate to meet local requirements. Production figures for 1948-49 and 1949-50 were—

PRODUCTION:	1948-49	1949-50
Belting—	ft.	ft.
Flat transmission	1,592,528	2,375,356
Conveyor and V-belting . .	550,390	1,964,401

Belting production since June 1950 has increased. Imports of rubber belting in 1948-49 were valued at £16,000 and in 1949-50 at over

£36,400. Exports of rubber belting, mainly to New Zealand, were valued at £29,000 in 1948-49, and at about £11,500 in 1949-50. (See Chapter 14 for comment on production of leather belting.)

RUBBER THREAD is made in Australia by only one manufacturer, who makes cut thread. Production is not sufficient to meet demand, but is increasing. No statistics are available. Extruded round thread, which is preferred by elastic cloth and tape manufacturers, is all imported. Imports of all types of rubber thread in 1948-49 were valued at £126,750 and in 1949-50 at £56,391. Exports in 1948-49 were valued at £1,840 and in 1949-50 at £4,234.

Several manufacturers provide a service for the application of natural and synthetic rubbers and rubber mixtures as LININGS and COATINGS for resistance against abrasion and corrosion, particularly acid-corrosion.

In addition to the items specifically mentioned above, there is a very large variety of miscellaneous INDUSTRIAL RUBBER GOODS produced in Australia. Individual production figures are not collected, but it is estimated that the total annual value of output of such goods would be not less than about £3.5 millions.

MISCELLANEOUS PRODUCTS

Miscellaneous rubber goods cover a wide range of uses. The principal items are mentioned below. In some of these fields, the development of the use of thermoplastic materials, particularly polyvinyl-chloride (P.V.C.) has increased competition. The largest rubber-products manufacturer in Australia has a subsidiary company solely engaged in the manufacture of P.V.C. calendered and extruded products. Chemical proofing of fabrics for rain-wear is in many cases replacing the older rubber-coating process.

The production of RUBBER GARDEN HOSE in Australia is sufficient to meet the demands of the local market. Total output of rubber hose in 1948-49 was 15.4 million feet, but about 8 million feet was industrial hose (see above). In 1949-50 output increased to 17.5 million feet. (For information on production of P.V.C. garden hose, see Chapter 7.) Because of the increasing use of plastics hose, the demand for rubber garden hose is not expected to increase very greatly above the present level of between 7 and 8 million feet a year.

Output of RUBBER SHEETING in 1948-49 was 161,830 sq. yds. (valued at £26,679), compared with a prewar demand for about 200,000 sq. yds. a year. In 1949-50, output declined to 68,899 sq. yds. This is another field where plastics are competing with the older rubber products. Value of imports of hard rubber sheets in 1948-49 was £4,584 (257 cwt.) and in 1949-50, £4,176 (272 cwt.), and of soft rubber sheets and strips, £9,302 in 1948-49 and £9,146 in 1949-50.

There has been a considerable expansion of the production of LATEX FOAM CUSHIONING in Australia in recent years. Its principal uses are for upholstery and mattresses. In

addition, both latex-foam and blown-sponge types of CARPET UNDERLAY are made in Australia. Though the price of these rubber products is generally considerably higher than alternative materials used for similar purposes, their use is nevertheless expanding. Total production of "sponge-rubber" in 1948-49 was 1,244,739 lbs., and in 1949-50 about 1,724,000 lbs. Imports and exports of latex-foam and sponge rubber products are not separately specified, but are believed to be small.

The demand for RUBBER FLOORING is in excess of Australian production, and some imports are necessary. Output in 1949-50 was 225,235 sq. yds. and 510,449 lbs. of rubber floor mats. Imports were valued at £137,104. Exports are negligible. Australian capacity is considerably higher than present production, and would be sufficient to supply requirements.

Production of RUBBER GLOVES in Australia in 1948-49 totalled 1,024,813 pairs, and in 1949-50, 1,392,000 pairs. Imports in 1948-49, including surgeons' gloves, were 48,500 pairs, but fell in 1949-50 to about 27,700 pairs. Some medical men prefer to use imported rubber gloves, even though good-quality Australian gloves are available.

Although production of RUBBER FOOTWEAR is firmly established in Australia, output for the past few years has not been sufficient to meet market requirements, and considerable quantities have been imported. In 1949-50, the Australian industry made 534,689 pairs of rubber boots of all kinds and 3,171,366 pairs of rubber shoes. In that year, 409,000 pairs of goloshes, rubber sand boots and shoes and plimsolls were imported and 427,000 pairs of gum and wading

boots. Exports of rubber footwear from Australia in 1949-50 were valued at £10,445. Australian production of rubber boots and shoes has been steadily expanding and is now adequate to meet the demand.

Practically all of Australia's requirements of FOOTWEAR RUBBER STOCK and REPAIR MATERIALS are manufactured here. Output in 1948-49 consisted of 1.5 million pairs of soles, 756,000 pairs of heels, nearly 6 million pairs of soles and heels and 1.14 million lbs. of material for rubber soles. Imports and exports are not specified in statistics, but are negligible.

Other rubber products produced in appreciable quantities in Australia include RUBBER TUBING, output of which in 1949-50 was 1.95 million feet; HOT-WATER BOTTLES; GOLF BALLS and TENNIS BALLS. Although only 648,142 hot-water bottles were made in 1949-50, capacity is substantially higher, and it is mainly the shortage of labour which prevents the Australian industry from supplying all local requirements. Production of tennis balls in 1948-49 was 285,200 dozen, which increased

to 304,000 dozen in 1949-50, and 276,300 dozen in 1950-51. In 1949-50, about 132,000 dozen golf balls were made in Australia, and 159,300 dozen in 1950-51. Imports of hot-water bottles in 1948-49 were appreciable (557,000 lbs. valued at £114,480), but in 1949-50 fell to only 46,700 lbs. valued at £9,630. There is not much import of rubber tubing or tennis balls; small quantities of tennis and golf balls are exported from Australia.

Imports in 1949-50 of AIR and WATER BEDS, AIR CUSHIONS and PILLOWS, and CUT-SHEET SURGICAL TUBING were valued at £3,319 (£5,750 in 1948-49); of RUBBER SYRINGES, ENEMAS, INJECTION BOTTLES and URINALS, £4,542 (£36,080 in 1948-49); and of other miscellaneous rubber manufactures about £242,000. No figures of Australian production of these items are available. There tends to be a definite preference for imported surgical rubber goods by many Australian consumers. The Australian output of such goods is small, as the industry finds it cannot compete against imported goods.

RECONDITIONING OF TYRES

Retreading and recapping of tyres became of major importance during the 1939-45 War, and reconditioning capacity in Australia was substantially extended.

Until recently, tyres were not freely available, and the necessity to conserve those

available led to an increasing demand for reconditioning. In 1948-49, over 786,200 tyres were recapped or retreaded in Australia, and in 1949-50 over 990,000 tyres. Quantities of camel-back used totalled 7.69 million lbs. in 1948-49 and 8.56 million lbs. in 1949-50.

Part Three: Basic Statistics

COMPARATIVE STATISTICS, 1938-39/1949-50

NUMBER OF ESTABLISHMENTS AT 1938-39 AND 1949-50

NUMBER OF EMPLOYEES AT 1938-39, 1949-50, JUNE 1950, SEPTEMBER 1951

Activity (Statistical Sub-classes used by Commonwealth Statistician, 1949-50)	Establishments		Employees			
	1938-39	1949-50	1938-39	1949-50	June 1950 (a)	Sept. 1951 (a)
Rubber Goods (including Tyres made) (b)	no. (c) 299	no. (d) 78	no. (c) 7,502	no. (d) 10,514	no. 11,412	no. 11,816
Tyre Retreading and Repairing		(d) 326		(d) 1,868	1,508	1,734
Totals (e)	299	404	7,502	12,382	13,010	13,550

STATISTICAL SUMMARY, 1949-50

EMPLOYMENT, MALE AND FEMALE

SALARIES AND WAGES PAID, IN TOTAL AND PER PERSON ENGAGED

VALUE OF PRODUCTION

VALUE OF MATERIALS, POWER, FUEL, REPAIRS, etc.

VALUE OF OUTPUT

See Explanations,
Appendix IV

Activity (Statistical Sub-classes used by Commonwealth Statistician, 1949-50)	Employment			Salaries and Wages Paid		Value of Pro- duction	Value of Materials, Fuel, etc. Used	Value of Output
	Males	Females	Persons	Total	Per Person Engaged			
Rubber Goods (including Tyres made) (b) (d)	no. 8,078	no. 2,436	no. 10,514	£'000 5,482	£ 521	£'000 7,956	£'000 14,674	£'000 22,630
Tyre Retreading and Repairing (d)	1,694	174	1,868	703	376	1,414	1,457	2,871
Totals (e)	9,772	2,610	12,382	6,185	499	9,370	16,131	25,501

Explanatory Footnotes to Both Tables

- (a) These employment figures are taken from monthly payroll-tax returns and differ slightly from the other employment figures, which are supplied on annual factory returns.
- (b) Includes rubber-soled footwear with canvas or rubber uppers, but does not include rubber-proofed garments nor rubber-spreading of fabric where carried on as an ancillary activity in an establishment mainly engaged in production of garments.
- (c) At 1938-39 the present sub-classes "Rubber Goods (including Tyres made)" and "Tyre Retreading and Repairing" made up three sub-classes entitled "Rubber Boots and Shoes", "Tyres, Motor and Cycle" and "Other Rubber Goods".
- (d) Establishments in Tasmania classifiable within the sub-class "Rubber Goods (including Tyres made)" were included in the sub-class "Tyre Retreading and Repairing".
- (e) Consideration and comparison of totals must take into account the effects stated in footnotes explaining the composition of certain sub-classes and figure units.

Chapter 9 :

METALS

SHAPES

PIPES

TUBES

CASTINGS, including DIECASTING

FORGINGS, including BLACKSMITHING

Part One: Structure of Established Manufacturing Activities

THE smelting, refining, alloying, and recovery of ferrous and non-ferrous metals (including precious metals), the manufacture of intermediate and finished shapes of metals, the manufacture of metal pipes and tubes, and the activities of metal casting and forging, are established in Australia as listed below. The listing is intended to be reasonably indicative, but not necessarily fully inclusive.

IRON AND STEEL, INTERMEDIATE AND FINISHED SHAPES OF STEEL, IRON PIPES, STEEL PIPES AND TUBES

Iron Works, Steel Works, Steel Mills, Ferrous Forges

In 1949-50 there were 30 and in 1948-49 32 establishments grouped in official statistics as being wholly or mainly engaged in this group of activities. However, this group (sub-class "Smelting, Converting, Refining, Rolling of Iron and Steel") of factory statistics is involved in its make-up, and not fully indicative of establishments and employment in the activities concerned. Thirteen of the establishments are sections (blast-furnaces, open-hearth furnaces, etc.) of four large "collective" establishments—three iron and steel works (one not integrated) and another steel works—and includes the direct-metal foundries operated at the two integrated iron and steel works, but not the coke-ovens and electric-power plants at those works. The two largest unintegrated steelmills, both engaged in sheet rolling, are not included within the group, being included in the sub-class "Galvanised Ironworking and Tinsmithing—Iron and Steel Sheets". At least six establishments of the 1948-49 grouping are steel foundries (for which there is another sub-class of statistics). Ferrous forges wholly or mainly engaged in that activity are in official statistics included with iron and steel works, but for the purposes of this study are described under the heading of "Forges, Ferrous and Non-ferrous", later this Part. Of the 32 establishments grouped in 1948-49 in the sub-class "Smelting, Converting, Refining, Rolling of Iron and Steel", 7 each employed not more than 50 persons, 6 each from 51 to 100 persons, and 19 each more than 100 persons. The latter 19 establishments employed 11,681 persons out of the group total of 12,351 persons; 8 of the establishments each employed more than 400 persons and together employed 9,078 persons.

IRON WORKS NOT INTEGRATED WITH STEELMAKING: Two establishments, one company and one State Government authority—

The Broken Hill Proprietary Co. Ltd. operates a blast-furnace (750-ton a day capacity) at its establishment at Whyalla, S.A., specifically for the supply of foundry iron; most of the

PIG-IRON in a full range of grades to meet general and specialised foundry requirements.

foundry iron made in Australia comes from this source. (The iron works at Whyalla is unintegrated in that there is no open-hearth steel works associated with it at the Whyalla establishment. The Whyalla blast-furnace is, however, integrated in the sense that it is operated by a company with integrated iron works, steel works and steel mills elsewhere in Australia—at Newcastle, and Port Kembla, N.S.W.—and enables the blast-furnaces at the integrated works to be concerned mainly with basic-iron requirements for steel making and only to minor extent with foundry iron. See next activity, "Iron Works, Steel Works, Steel Mills, Integrated", for further reference to organisation of The B.H.P. Co. Ltd., and its subsidiary and associate companies.) Manufacturing sections at the B.H.P. Whyalla establishment comprise blast-furnace plant; an electric-furnace plant for alloy-steel ingots (mainly for Commonwealth Steel Co. Ltd., a subsidiary company of The B.H.P. Co. Ltd.), casting steel for the Whyalla works foundry, and, at times, low-carbon ferro-manganese ferro-alloy; 5-slipway shipbuilding yard, with fitting-out wharf; steel foundry and engineering shops for general engineering and plant maintenance; gear shop, including turbine gears, and ship-engine construction shop being established. Iron-ore from nearby deposits (at present the principal source of iron-ore in Australia, operated by The B.H.P. Co. Ltd. is carried on a B.H.P. railway and loaded at the Whyalla establishment for sea transport to the Newcastle and Port Kembla establishments of the B.H.P. group. Salt production has been begun in an experimental way by The B.H.P. Co. Ltd. at a pan adjacent to the Whyalla establishment. The Charcoal-Iron and Wood-Distillation Works, Wundowie, W.A., produces foundry iron of high silicon content, with a small cold-blast furnace (40-ton a day capacity) using wood-charcoal remaining after wood-destructive distillation for acetic acid, acetone and methanol. The associated activities (including sawmilling of building timber) are operated by the State Government of Western Australia.

IRON WORKS, STEEL WORKS, STEEL MILLS, INTEGRATED: Two establishments, one company group—

The Broken Hill Proprietary Co. Ltd., at Newcastle, N.S.W., and its chief subsidiary company, Australian Iron & Steel Ltd., at Port Kembla, N.S.W., each operates an integrated iron works, steel works and steel mills establishment, the only such integrated works in Australia. (The works are not, however, engaged in steel-sheet rolling—see "Steel Works and Steel Mills, Combined", for stainless steel and shapes, and "Steel Mills, Unintegrated", for all other steel-sheet rolling.) The B.H.P. group also operates another iron works; a combined steel works and steel mills; two steel wire mills; five wire-products factories (including the two wire mills and a wire-rope factory); a wood-chisel and auger-bit factory; and is directly associated with, and supplying steel feed or finished shapes to, companies making seamless and welded pipe and tube, files and table knives, drums, structural-steel fabrications. The group operates, as integral parts of its overall activities, quarries for iron-ore, limestone, dolomite, magnesite, bauxite; collieries; ore and coal railways; loading jetties; shipping line; ship-building yard (and builds ship engines); gear shop; general-engineering shops, with foundries. (For further comment on industrial organisation and company structure of the B.H.P. group see the statement "Organisation and Association of Major Companies Within the Non-ferrous and Ferrous Metals Industries in Australia", at the close of this Part One.)

BASIC IRON for steelmaking and direct casting.

PIG IRON: Full range of grades can be made, but present practice is to make foundry pig-iron only from time to time as circumstances require (see "Iron Works Not Integrated with Steelmaking", above).

INGOT STEEL: Full range of carbon and special carbon steels; and alloy steels of electric-furnace origin. (Open-hearth alloy steel has been made when the quantity required is large enough.)

INTERMEDIATES (excluding those of stainless steel and certain other alloy steels): Blooms and billets for re-rolling and forging; plate slab; beam blanks; push-bench billets for seamless pipe manufacture; skelp; wire-rods; sheet-bars.

FINISHED SHAPES IN GENERAL-PURPOSE STEELS: Structural beams, channels, angles, etc.; rails (including grooved) and accessories; plate; hot-rolled and cold-rolled strip; merchant bar and sections, heavy to light, including flats, rounds, squares, tees, octagons, hexagons, angles, hoop, band, etc.

FINISHED SHAPES IN SPECIAL STEELS: Plates; merchant bar and sections, including flats, rounds, square, octagon and hexagon.

FERRO ALLOYS: Ferro silicon, ferro chrome high carbon, ferro manganese, and specialised ferro alloys in lesser quantity.

(Tungstic acid; tungsten powder; tungsten carbide in die-nibs, tool-tips, and specialised applications.)

(Spun-cast iron pipes.)

(Founding; forging; engineering; refractories making; electric-power generation; supply of crushed and graded slag and coke-oven by-products.)

The manufacturing sections of the Newcastle establishment comprise coal-cleaning plant and by-product coke-oven plant; by-products recovery plant, including tar distillation; blast-furnace plant (three furnaces, two each of 700-ton and one of 750-ton daily capacity); basic open-hearth plant; soaking pits; rolling mills (comprising ten units—bloom mill; structural and rail mill; sheet-bar and billet mill; plate mill; bar mill; continuous merchant-bar mill, also used for hot-rolled strip and skelp; cold-rolled strip mill; wire-rod mill; small tonnage manual mill; fish-plate and tieplate mill); ferro-alloy plant; tungsten powder and tungsten-carbide products plant; and steel foundry (with acid and basic open-hearth furnaces, and roll-casting section) for special-steel and alloy-steel ingots and castings, and castings of general-purpose steels. In addition to the usual sections for plant maintenance, quality control, stores, materials supply, and so on, the service sections include a steam-turbine electric-power plant of 47,500 kW, basic-refractories plant, direct-metal iron foundry, brass foundry. Feed supplied to other steel mills consists of sheet-bar, wire-rod, skelp, push-bench billets for seamless-pipe making, re-rolling billets for window-frame and light merchant sections.

The manufacturing sections of the Port Kembla establishment comprise coal-cleaning plant and by-product coke-oven plant; by-products recovery plant; blast-furnace plant (three furnaces, of 750-ton, 1,150-ton and 1,500-ton daily capacity—the 1,500-ton furnace was initially blown in recently and the 1,150-ton furnace was shortly afterwards taken out of production for overhaul and enlarging); open-hearth plant; soaking pits; rolling mills (comprising five mill units—bloom and plate mill; structural and rail mill; sheet-bar and billet mill; continuous merchant-bar mill; lighter section merchant-bar, rod, skelp, and hot-strip mill); and an electric-furnace plant for special steels. Service departments include a steam-turbine electric-power plant of 24,900 kW, foundries for steel, iron and non-ferrous castings, and engineering shops (also undertaking work for associated companies, collieries, etc.). The company also operates the only spun cast-iron pipe plant (De Lavaud method) in Australia. Feed supplied to other steel mills consists of sheet-bar, wire-rod, skelp, and re-rolling billets for light sections. (A.I. & S. Ltd. operates two large establishments, one at Melbourne, Vic., and one at Sydney, New South Wales, for fabrication of structural steel.)

(See Part Two for comment on the considerable extensions to the Newcastle and Port Kembla works, in construction and planned. Extensions by The B.H.P. Co. Ltd. and its subsidiary companies are mainly concerned with overall increasing of capacity for manufacture of coke, iron, steel, rolled steel products, steel wire, forgings, and the complementary increasing of capacity for mining of coal, quarrying, loading, and rail and sea transport. In extension of its steel-products mills, one new field is to be entered into—the manufacture of tinplate—but the rolling of black and bright steel sheet (not including stainless steel), the galvanising of steel sheet, the forming or drawing of steel pipe and tube, the drawing of bright-steel bar, is left to specialist steel mills (the principal pipe and tube makers are associate companies of The B.H.P. Co. Ltd.), all of which obtain all of their steel feed, or practically all of it, from either The B.H.P. Co. Ltd. or A.I. & S. Ltd., or both.)

STEEL WORKS AND STEEL MILLS, COMBINED, NOT INTEGRATED WITH IRONMAKING: Two establishments, two companies—

Commonwealth Steel Co. Ltd., at Newcastle, N.S.W. The company is a public company in which The B.H.P. Co. Ltd. owns about 82 per cent. of issued shares (and three leading non-ferrous metals companies between them hold about 8 per cent.). One establishment is operated, comprising a basic open-hearth furnace, three electric-arc furnaces, and two high-frequency furnaces; bloom mill and merchant mill; sheet mill and grinding and polishing plant for stainless-steel sheet; heat-treatment plant; tyre press and mill, horn hammer, machining and grinding shop for wheels, axles and tyres; steel foundry; forging-press shops; ball-mill ball forging, heat-treatment and grinding plant; machine and fabricating shops for finishing castings, forgings and other steel toolroom, maintenance shop, etc.

Melbourne Iron & Steel Mills Pty. Ltd., Melbourne, Vic., at Brooklyn ("Victoria Rolling Mills") operates a small steel works and steel mill (and forge shop, etc.), and is essentially a jobbing steel producer and rolling mill, consisting of three electric-arc furnaces, merchant-bar mill, forging press, and ancillary service sections. The works is based on selected scrap, particularly processing scrap, and is mainly concerned with special steels and alloy steels in merchant-mill products, mostly in special sections. Special sections are rolled in low-carbon and mild steels at times, from billets obtained from the B.H.P. group. Forging ingots and billets are produced to industry and ordnance specifications, and slabs and heavy forgings are made. Bolts, nuts and rivets have been made at times (depending on labour availability in recent years). The company also operates a steel mill elsewhere for rolling of light sections—see "Steel Mills", below.

STEEL MILLS NOT INTEGRATED WITH STEELMAKING, for Sheet, Pipe (continuous-weld and seamless hot-rolled), Tube (seamless cold-drawn and continuous-weld), Wire, Sections, Bright Bar: Fifteen establishments, twelve companies. The activities of manufacture of pipe, tube, wire and coated sheet are not grouped in official statistics with iron works, steel works, and steel mills. Instead, the manufacture of metal pipe, tube, conduit, and fittings, and pipe and tube manipulation, are placed in a separate statistical group, and wiremaking and wireworking sheet mills which are producing coated sheet and black commercial sheet are, in official statistics, included in "Galvanised Ironworking, Tinsmithing", but for the purposes of this study are described with steel mills; the description is set out immediately below, and is followed by light-section rolling and bright-bar drawing. The steel mills not integrated with steelmaking consist of eight establishments, six companies—

Lysaght's Works Pty. Ltd. is concerned almost entirely with rolling and coating of steel sheet of which, other than stainless-steel sheet (made only by Commonwealth Steel Co. Ltd., Newcastle, N.S.W., a B.H.P. company—see "Steel Works", above), it is the only producer in Australia. Three establishments are operated. The company is wholly owned by John Lysaght Ltd., U.K., which is itself a subsidiary company of Guest, Keen and Nettlefolds Ltd., U.K., (see "Organisation and Association of Major Companies within the Non-ferrous and Ferrous Metals Industries in Australia" at the close of this Part). Lysaght's Works Pty. Ltd. is not associated in company structure with the B.H.P. group, from the iron and steel works of which it draws the sheet-bar feed for its three sheet mills. The largest of the three mill establishments is at Newcastle, N.S.W., adjacent to the iron and steel works of The B.H.P. Co. Ltd.; hot rolling is used throughout, to produce galvanised sheet and "Zincanneal" sheet in flat and corrugated, and electrical sheet. The other two mill establishments are at Port Kembla, N.S.W., adjacent

SPECIAL AND ALLOY STEELS: Special carbon; general-purpose high-speed; tool and die, including die blocks; heat-resistant in bar or billet.

STAINLESS STEEL in sheet, strip, rod, sections.

AXLE, TYRE AND WHEEL STEEL (also partly fabricated or fully fabricated into axles, tyres, wheels, for railways and tramways use).

(Steel castings, up to 35 tons weight.)

(Steel forgings from ingots up to 50 tons.)

(Ball-mill balls; dredge buckets; railways and tramways rail points and crossings; and similar items of specialised engineering.)

products; service departments such as roll shop,

SPECIAL AND ALLOY STEELS: High-carbon tool steels, excepting high-speed steels; spring steels; agricultural steels; alloy steels, in particular for ordnance, automotive, railways usage, including gun steels, handtool steels (for ring-grip spanners and sockets, adjustable wrenches, knives) and other forging steels, valve steels, ballrace steels; and other steels to special specification.

INGOTS AND BILLETS for forging.

SECTIONS: Standard and special sections in light merchant-bar range for special steels and alloy steels; special sections include grader blade, beater blade, mower blade, plough-beam tyne, rim stock for cans and pans, fire or screen bars, taper and spiral spring section, special angles and channels. Special section in low-carbon and mild steels (billets normally obtained from the B.H.P. group) include motor-wheel rim stock, wire-rope thimble.

(Steel forgings, up to 6 tons.)

(Bolts, nuts and rivets.)

COATED SHEET: Galvanised, plain and corrugated, in two grades of hardness and two qualities of coating: "Zincanneal", flat and corrugated; andterneplate.

BLACK SHEET: Light to heavy gauges, and including high-carbon sheet and light plate, and electrical sheet in motor, dynamo and transformer grades.

BRIGHT SHEET: Six grades in qualities suited for flat work, ordinary drawing, and deep-drawing or spinning; and tack sheet.

(A small fabricating section is operated, producing mainly at present prefabricated silos, and nursery tubes for seedlings.)

The largest of the three sheet mills. The largest of the three mill establishments is at Newcastle, N.S.W., adjacent to the iron and steel works of The B.H.P. Co. Ltd.; hot rolling is used throughout, to produce galvanised sheet and "Zincanneal" sheet in flat and corrugated, and electrical sheet. The other two mill establishments are at Port Kembla, N.S.W., adjacent

to the iron and steel works of Australian Iron and Steel Ltd.; one establishment uses hot rolling throughout and produces commercial black sheet (mainly) and galvanised sheet in flat and corrugated; the other establishment (Lysaght's C.R.M. Division, formerly Commonwealth Rolling Mills Pty. Ltd.) operates its own hot-roll mills for feed for the cold-roll mill, to produce from the sheet-bar stage high-finish bright sheet in various grades and properties. (The C.R.M. establishment is being equipped with a reversing cold mill to operate with hot-rolled strip, which initially will be obtained from overseas, and about 1956 from A.I. & S. Ltd. The Port Kembla black-sheet and coated-sheet mill will also be equipped to cold roll for black and coated sheet, using A.I. & S. hot-rolled strip—see Part Two.)

Melbourne Iron and Steel Mills Pty. Ltd., at its "Lion Rolling Mills", Melbourne, Vic., operates a small mill for light sections, mainly in mild steel, and normally outside the range of the B.H.P. group, from which the rolling billets are obtained. (The company operates elsewhere a steel works establishment—see "Steel Works", above.) **K.M. Steel Products Ltd.**, Melbourne, Vic., operates a light-section mill as an integral part of its principal activity of fabricating steel window frames. Rolling billets are supplied by the B.H.P. group.

LIGHT SECTION: Window section mainly, and special sections.

Bright Steels Pty. Ltd., Sydney, N.S.W. (subsidiary company of a steel and general merchanting company), is concerned only with bright-bar manufacture, in mild, alloy and aircraft steels, to various grades, in round (including precision ground to standard or special tolerance, or oversize for grinding by user), square, hexagon, flats, and special bar-section to order (angle section is not made in Australia). **Brunton's Bright Steel Pty. Ltd.**, Melbourne, Vic. (a subsidiary company of a large holding company of which the principal glass-products manufacturing companies in Australia are also subsidiaries), is concerned only with manufacture of bright bar and bright nuts and bolts. Classes, grades and sections of bar made are similar to those stated for Bright Steels Pty. Ltd. except that grinding of round is not done. **H. V. McKay-Massey Harris Pty. Ltd.**, Melbourne, Vic. (the largest manufacturer of agricultural implements in Australia, and practically confined to that field), draws round section at its Sunshine, Vic., establishment, mainly for own use, and to supply the trade when materials are available.

BRIGHT BAR: In carbon and alloy steels to various grades, in round, precision round, square, hexagon, flats, and special section to order.

Ferrous Pipe, Tube, Conduit, Fittings, Manipulation, Fabrication

In 1949-50 there were 39 and in 1948-49 35 establishments wholly or mainly engaged in one or more of the activities of manufacture of metal pipe of all kinds, of drawn and welded tube, of welded and close-joint conduit, of fittings for pipe, tube and conduit, and manipulation of pipe and tube. Of the 1948-49 establishments 9 each employed up to 10 persons, 8 each from 11 to 20 persons, 5 each from 21 to 50 persons, 5 each from 51 to 100 persons, and 7 each more than 100 persons; the latter 7 establishments collectively employed 4,777 persons out of the industry total of 5,535 persons. The structure set out below shows Tubemakers of Australia Ltd. (a holding company, not itself manufacturing) to be predominant in the pipes, tubes and fittings industry in Australia. The company is an association of Stewarts & Lloyds Ltd., Tube Investments Ltd. (both United Kingdom companies, each with holdings in the other), and The Broken Hill Proprietary Co. Ltd. (See "Organisation and Association of Major Companies Within the Non-ferrous and Ferrous Metals Industries in Australia" for comment on structure of the B.H.P. group of subsidiary and associated companies.)

CAST PIPE AND FITTINGS, for Water and Sewerage Reticulation: About 15 manufacturers. Only one company (Australian Iron & Steel Ltd., Port Kembla, N.S.W.) makes spun-cast iron pipes; that company has the largest output of the pipe manufacturers, but does not make fittings. Most of the remainder of output of cast pipe, and practically all fittings, are made by eight manufacturers—a State water-supply authority, a large engineering company, a company principally concerned with manufacture of stoves, ranges, baths and basins, and five jobbing iron-foundries. Six other iron-foundries make pipe and fittings as a lesser part of general jobbing activities.

FABRICATED STEEL PIPE, for Water Mains, Oil Lines, etc.: Five companies, twelve establishments, comprise the regular makers of fabricated steel pipe. **Humes Ltd.** (through its subsidiary company Hume Steel Ltd.) operates six establishments, one each in New South Wales, Victoria, South Australia and Western Australia, and two in Queensland. Other steel fabricating work is done—tanks, road tankers, chimney stacks, air-receivers, etc. (Humes Ltd. is the largest manufacturer of concrete pipes in Australia.) **Mephan Ferguson Pty. Ltd.** operates three establishments, one each in New South Wales (Mephan Ferguson (N.S.W.) Pty. Ltd.), Victoria and South Australia. A variety of plate-steel fabricating work is done. (The company is a wholly-owned subsidiary of Tubemakers of Australia Ltd.—see above.) **Mori's Dock and Engineering Co. Ltd.**, at one of its establishments at Sydney, N.S.W.; the company is principally engaged in ship and ship-engine repair and construction, ship docking, general engineering, etc. **Cowley's Eureka Ironworks Ltd.**, operates one establishment, at Ballarat, Vic.; other plate-steel fabricating and general engineering is carried out. **K. B. Hume & Co.** operates one establishment at Broken Hill, N.S.W., principally for the Darling River/Broken Hill water pipeline now being constructed.

PIPING, TUBING, CONDUIT, FITTINGS, MANIPULATION, FABRICATION: Two establishments, two companies, make piping and fittings, and manipulate, fabricate; one establishment, one company, makes tubing and manipulates, fabricates; seven establishments, six companies, make electrical conduit, three also making conduit fittings; several companies and businesses make conduit fittings (but not conduit); a few companies and businesses are concerned mainly with manipulation, fabrication, of piping, tubing, etc., and installation of pipelines for steam, air, gas, etc. Details are as follows—

Stewarts & Lloyds (Aust.) Pty. Ltd., Newcastle, N.S.W., and Adelaide, S.A., and **Stewarts & Lloyds (South Australia) Ltd.**, Adelaide, S.A. (both subsidiary companies of Tubemakers of Australia Ltd.—see above). The manufacturing sections at the Newcastle establishment comprise two mills making continuous-weld pipe in sizes from $\frac{1}{2}$ in. to 3 in. nominal bore; push-bench and reduction mill, making hot-rolled seamless pipe and tube in sizes from $2\frac{1}{2}$ in. to $8\frac{1}{2}$ in. outside diameter; galvanising shop; screwing shop; wrought-steel pipe socket and fittings shop; and pipe-manipulation shop (particularly for large-size work, including high-pressure steam installations). Pipe skelp and billet bar is supplied by the B.H.P. group, the Newcastle works of which is adjacent to the S. & L. works. The manufacturing sections at the establishment of Stewarts & Lloyds (South Australia) Ltd., Adelaide, comprise push-bench and reduction mill (push-bench billets from B.H.P. group) making light-gauge of pipe and tube in sizes from 1 in. to $3\frac{1}{2}$ in. outside diameter, mainly "hollows" for the adjacent cold-drawn tube mill of British Tube Mills (Aust.) Pty. Ltd.; and manipulation shop, for small fabricated work. A malleable shop (integrated from pattern-making to finished fittings) for water and gas pipe fittings, malleable, black and galvanised, $\frac{1}{2}$ in. to 2 in. nominal bore, is operated at Adelaide (and located adjacent to the previous establishment) by Stewarts & Lloyds (Aust.) Pty. Ltd. There is no other manufacturer of steam, gas and water pipe in Australia.

British Tube Mills (Aust.) Pty. Ltd., Adelaide, S.A. (a subsidiary company of Tubemakers of Australia Ltd.—see above), is the only manufacturer in Australia of cold-drawn seamless steel tube, and of electric-welded precision steel tube made by the automatic continuous-forming and electric-welding process. It is also the principal manipulator of tubing into semi-finished and finished components for numerous trades, in some instances the only supplier; the principal maker of high-pressure gas cylinders; and has the only plant in Australia for making of chainwheel and cranks (also making head fittings and bottom bracket fittings) for the cycle-manufacturing trade (ancillary to B.T.M. tubular components and wheel rims for the cycle trade). The manufacturing sections at B.T.M.'s establishment consist of a draw mill; a weld mill; tube-manipulating shop (including coating, enamelling, plating plant); high-pressure gas-cylinder shop and non-tubular cycle fittings shop. Hollows for tube drawing are obtained from the adjacent hot-rolled pipe mill of Stewarts & Lloyds (South Australia) Ltd., and from the Newcastle mill of Stewarts & Lloyds (Aust.) Pty. Ltd. Strip for electric-welded tube is obtained from the B.H.P. group. B.T.M.'s manipulating activities apply to semi-finished and finished products

wrench and socket sets; golf-club shafts; nesting chairs, tables, stools, and to trade work of a full trade service (most tube manipulators are so engaged as an integral activity in manufacture of products of which tubing forms a prominent part, such as tubular-steel furniture).

Electrical Conduit and Fittings: Four manufacturers of RIGID CONDUIT. **Acme Conduit Pty. Ltd.**, Sydney, N.S.W., makes close-joint conduit, electric-welded screwed conduit, and a limited range of fittings. (The company is associated at the same address with businesses engaged in tool-making; metal pressing and stamping; and manufacture of metal bedsteads of all types and of tubing for fabrication is secured from British Tube Mills (Aust.) Pty. Ltd.—see above.) **Altube Ltd.**, Adelaide, S.A., makes close-joint conduit and fittings. **Automatic Tube Co. Pty. Ltd.**, with two factories, one at Melbourne, Vic., one at Sydney, N.S.W., makes close-joint conduit and electric-welded screwed conduit; fittings are not made. (The company is a wholly-owned subsidiary of Tubemakers of Australia Ltd.—see above.) **Sterling Tube & Pipe Pty. Ltd.**, Melbourne, Vic., makes close-joint conduit; fittings are not made. **Westate Tube & Engineering Pty. Ltd.**, Perth,

PIPING, FITTINGS, MANIPULATION: Continuous-weld (Fritz-Moon process)—water, gas, ammonia, steam; black, galvanised; screwed, socketed, plain-end. (Steam pipe, $1\frac{1}{2}$ inches outside diam., is also widely used in Australia for scaffolding tube.)

Seamless hot-rolled (Wellman-Seaver push-bench and reduction process)—plain end tubes; screwed and socketed, galvanised and black (including steam); hollows for cold-drawn seamless tube manufacture; bore casing, black and galvanised; boiler and stay tubes; A.P.I. pipe line; hydraulic pipe; victaulic-joint pipe and fittings.

Pipe fittings: wrought-steel, and malleable.

Pipe manipulation, or fabricating of very wide range.

TUBING AND MANIPULATION:

Seamless, precision cold-drawn (draw-bench process), .032 in. to 6 in. outside diameter in stock sizes, in general-purpose, special and alloy steels (excluding stainless tube, which is not made in Australia); drawn to standard and special tolerances in circular, square, hexagonal, oval, D-section, special section, parallel, butt and taper gauge, eccentric bore, concentric tube, high-precision bore ("Solex" tested), telescoped, lined; supplied in wide stock range of conditions, surface finishes and heat treatment, or to special specifications. Includes pressure tubes for refrigerators, internal-combustion engines, boilers and superheaters, sealed tubes (for ovens), Bourdan tubing, capillary tubing. Includes composite tubing—steel tube with non-ferrous tube drawn into mechanical weld with each other.

Electrically-welded precision tube (automatic continuous form and weld process) in general-purpose steel, circular section.

Drawn welded-tube (cold-drawn electrically-welded tube) in circular and non-circular sections.

Tube manipulation, or fabricating, producing finished or semi-finished articles, by cutting, tapering, expanding, reducing, flangeing, doming, beading, bending, slotting, trapping, lapping, drilling, piercing, screwing, spinning, welding.

W.A., makes close-joint conduit and fittings, electric motors, alternators and generators. Two manufacturers of FLEXIBLE CONDUIT. **Flexible Tubes Pty. Ltd.**, Sydney, N.S.W. (subsidiary company of Frank G. Spurway Pty. Ltd.—see below), makes flexible tubing of electro-galvanised steel or non-ferrous metals, including packed tubing (packed with cotton, rubber or asbestos, for use where wiring is to be protected against damp, fumes, etc.); tubing can be made in square lock, gas section, and interlocked. **J. G. Dilling**, Sydney, N.S.W., makes flexible tubing and wiring fittings. — FITTINGS are made by several manufacturers in addition to those conduit makers also making fittings. One of the principal manufacturers of fittings, **Frank G. Spurway Pty. Ltd.**, Sydney, N.S.W., has a range of grip-type and screwed fittings, including inspection fittings and junction boxes, screwed couplings, nipples, locknuts, screwed unions, and reducing sockets, and also makes switches and switch fuses, wall boxes and spacers, strap clips, cable logs, battery clips, flexible connectors and elbow flexible connectors; one subsidiary company makes flexible tubing of galvanised steel or non-ferrous metals, and another subsidiary company makes metal-thread screws and nuts, and rivets, of wide range.

Pipe Manipulation and Fabrication: In addition to the two manufacturers of piping and tubing (see above), a few companies and small businesses specialise in bending and fabricating of ferrous and non-ferrous piping and tubing for use by other manufacturers, and/or as part of contract building of pipeline installations for steam, air, gases, etc.

Wiremaking and Wireworking

In 1949-50 there were 200 and in 1948-49 195 establishments wholly or mainly engaged in the activity of wireworking. Only three of the establishments make wire from Australian-made steel for sale as wire. (The drawing of copper wire for bare and insulated electrical and telecommunication wires and cables, where carried on as the sole or principal activity, or in conjunction with insulating of wire or cablemaking, is included in official statistics with "Electrical Machines and Apparatus", Chapter 11.) Of the 195 establishments in 1948-49, 102 each employed up to 10 persons, 42 each from 11 to 20 persons, 31 each from 21 to 50 persons, 12 each from 51 to 100 persons, and 8 each more than 100 persons. The latter 8 establishments collectively employed 2,717 persons out of the industry total of 5,825 persons; the 51-100 group employed 889 persons, the more-than-20 group employed 5,699 persons, and the not-more-than-20 group employed 1,120 persons. The structure set out below shows The Broken Hill Proprietary Co. Ltd. to be predominant in steel wiremaking in Australia, and of major significance in manufacture of certain products of wire. (See "Organisation and Association of Major Companies Within the Non-ferrous and Ferrous Metals Industries in Australia", later this Part, for comment on structure of the B.H.P. group.)

WIREMAKING, of STEEL—Annealed, Bright, Tempered, Alloy, Galvanised, Tinned, Coppered, Argentised, Varnished: There are only three manufacturers of wire from Australian-made steel for sale as wire—

Rylands Bros. (Aust.) Pty. Ltd. is the largest manufacturer of wire in Australia, and is a major producer of certain wire products. One establishment is operated, at Newcastle, N.S.W., adjacent to the iron and steel works of The Broken Hill Proprietary Co. Ltd., of which company Rylands Bros. is a subsidiary. Round and rod for drawing is supplied from within the B.H.P. group. A full range of annealed, bright and coated wires in standard and special gauges is produced. Wire made for wireworkers and other users includes the following: Barbing, weaving, stranding (wire rope) and other galvanised fabricating wire; spring wire, including aircraft standard; tyre-bead wire; cycle-spoke wire; mattress wire; stitching wire; box-strapping wire; boot and shoe wire and sections; telephone wire; core wire for steel-cored stranded-conductor cables; armouring and reinforcement wire for insulated electric cables; bright reinforcement wire; stock for nails, screws, rivets, steel wool, pins, files, small chisels, bobby-pins; core wire and rod for welding electrodes; bolt wire; nut strip; chain wire. Wire products made for supply to merchants include plain fencing; barbed fencing; netting; wire-fence (hinged-joint field fencing); nails, clouts, brads, staples; stitching wire. Other products made are steel fencing-posts (section supplied from within the B.H.P. group), keyhole ties for wool bales, and tungsten-carbide dies for drawing and extruding operations by industry generally. (By early 1953 Rylands Bros. expects to be producing manufacturers' wire at its Geelong, Vic., factory, now being established.)

Lysaght Bros. and Co. Pty. Ltd. operates one establishment, at Sydney, N.S.W. The company is a subsidiary of The B.H.P. Co. Ltd., and obtains its round and rod for wire drawing from within the B.H.P. group. The range of wire made for wireworkers and other users is not as wide as that of the associate company, Rylands Bros. (Aust.) Pty. Ltd. (see above), and includes galvanised fabricating wire; netting wire; nail wire; bright wire for reinforcement work; bolt wire; chain wire. Wire products made for supply to merchants include plain fencing; barbed fencing; netting; baling wire; nails, brads, panel pins, clouts, staples. The company also makes dry zinc oxide for general sale.

West Australian Netting and Wire Co. Ltd. operates one establishment, at Perth, W.A. Wire-rod is obtained from the B.H.P. group. Galvanised fabricating wire, varnished black wire, annealed wire and nail wire are made for wireworkers. Products made for supply to merchants are plain fencing wire, barbed fencing wire, baling wire and wire netting.

One other wireworking company, making nails, brads, metal-thread screws, steel and brass wood screws, and tacks, draws from steel wire-rod for its own use; and a few other wireworking companies draw down from heavy-gauge wire for their own use.

(A **concrete-pipe manufacturer** draws most of its requirements of reinforcement wire from wire-rod, and an agricultural-implement manufacturer making bolts, nuts and link-chain for sale draws from round and rod.)

WIREWORKING: About 200 establishments. For details see "Wireworking", Chapter 12, "Machinery, Plant, Equipment, Apparatus, Not Elsewhere Included".

(**BOLTS AND NUTS, SCREWS, CHAIN:** See Chapter 12, "Machinery, Plant, Equipment, Apparatus, Not Elsewhere Included".)

NON-FERROUS METALS, INTERMEDIATES AND FINISHED SHAPES

Non-ferrous Metals Smelting, Refining, Alloying, and Scrap Re-melt—Base-Non-ferrous Metals, Minor and Rarer Industrial Metals, Precious Metals

In 1949-50 there were 62 and in 1948-49 56 establishments wholly or mainly engaged in non-ferrous metals smelting and/or refining, or (in most instances) recovery from scrap metals. Of the 56 establishments, 26 each employed up to 10 persons, 9 each from 11 to 20 persons, 7 each from 21 to 50 persons, 2 each from 51 to 100 persons, and 12 each more than 100 persons. Five of the latter 12 establishments collectively employed 6,457 persons out of the industry total of 7,043 persons. Mining activities, including processing to the concentrates stage, are excluded from the statistical grouping.

LEAD, ZINC (and Associated Silver, Gold, and Other Metals): Three establishments, three companies. (For comment on industry and company relationships between the companies named below, and between those companies and mining companies, other smelting/refining companies and companies fabricating finished shapes (or forms), see the statement "Organisation and Association of Major Companies Within the Non-Ferrous and Ferrous Metals Industries in Australia" at the close of this Part.)

The Broken Hill Associated Smelters Pty. Ltd., Port Pirie, S.A., is the only producer of market lead in Australia. Its smelter/refinery is the largest in the world and the only one operating in full the continuous lead-refining process, which was originated by the company. Capacity is 170,000 tons a year of refined lead. All the lead concentrate from the Broken Hill mines (which is the greater proportion of lead concentrate produced in Australia) is smelted at Port Pirie, and the resulting bullion refined there also. Other lead-bearing materials treated are a portion of the lead-silver residue produced at the zinc refinery at Risdon, Tas., and small parcels of lead concentrate and silicious lead-bearing ores from various small mines throughout the Commonwealth. The principal products are market lead of exceptional purity, antimonial-lead, silver and gold. Cadmium is continuously recovered from the lead-smelter gas. Copper matte and speiss produced in the process of refining base bullion are treated at the copper smelter/refinery at Port Kembla, N.S.W. (The B.H.A.S. Pty. Ltd. operates as managing agents for The Electrolytic Zinc Co. of Australasia Ltd. (see below) a contact sulphuric-acid plant, treating the gas resulting from roasting of Broken Hill zinc concentrates; the calcine is forwarded to Risdon, Tas., and the acid distributed to superphosphate works in South Australia. In anticipation of The Electrolytic Zinc Co. transferring the whole of their zinc-concentrate roasting operations from the mainland to Risdon, The B.H.A.S. Pty. Ltd. is in process of erecting a contact sulphuric-Lloyd blast-roasting plant (the first stage in treatment of lead concentrate); as an interim measure the plant is being equipped with a brimstone-burning section. Lead-smelting practice at Port Pirie has been to produce a lead blast-furnace slag carrying about 18 per cent. zinc, and there is about 5 million tons of such slag in granulated form available for treatment at a later date.) **Mount Isa Mines Ltd.**, Mt. Isa, Qld., smelts its lead concentrate at the mine and ships the resulting silver-lead bullion to an associated refinery in the United Kingdom and copper-lead dross to the U.S.A. Zinc concentrate from the same company is shipped mainly to Belgium. (See "Copper" for comment on copper smelting and refining activities arising from the separate copper ore-body at the Mount Isa mine.)

LEAD: Market pig, including antimonial-lead (and associated production of silver, gold, cadmium, copper matte and speiss).

SILVER-LEAD BULLION.

The Electrolytic Zinc Company of Australasia Ltd. is the only producer of metallic zinc in Australia; its treatment works are at Risdon, near Hobart, Tas. About three-fourths of the zinc concentrate is secured from the Broken Hill mines (of Broken Hill South and North Broken Hill), and the remainder from E.Z.C.'s own mines at Rosebery and Williamsford, west coast of Tasmania. (Two grades of lead concentrate are produced at the mines, and as they are not acceptable for treatment in Australia they are

ZINC: Slab, diecasting alloy ingot, zinc dust, zinc sulphate (and associated production of cadmium, cobalt oxide, sulphuric acid, superphosphate).

currently being sold to smelters in the U.S.A.) Capacity of the electrolytic refinery is 100,000 tons of zinc a year (but a serious power shortage and interruptions to supply of concentrate and calcine have allowed a maximum production of 87,500 tons only). Associated products are zinc dust, zinc sulphate, cadmium (main producer in Australia) and cobalt oxide (65 per cent. Co) (only producer in Australia). Diecasting alloy for use in Australia is also made at Risdon from a specially-produced low-lead zinc. Portion of the lead residues is sent to the lead smelter/refinery at Port Pirie, S.A., and the remainder accumulated at Risdon. Sludges containing the copper, silver and gold content of the material treated at Risdon are sent to the copper refinery at Port Kembla, N.S.W. (Since its inception The Electrolytic Zinc Co. has progressively developed the manufacture of sulphuric acid from the sulphur content (about 31 per cent.) of zinc concentrate. Roasting and acid plants were established at Port Pirie, Birkenhead and Wallaroo, in South Australia and at Cockle Creek, in New South Wales. The acid produced at those plants is sold to superphosphate manufacturers, and the calcine shipped to Risdon for treatment in the zinc plant. The major portion of the zinc concentrate drawn from Broken Hill passes through the mainland plants; the balance is shipped direct to Risdon, where, with concentrate from the Company's own mines, it is roasted. The sulphuric acid produced at Risdon is mostly used in the manufacture of superphosphate to supply the full requirements of Tasmania; some is used in the process of zinc recovery, some sold to other Tasmanian users, and regular shipments of acid from Risdon are being made to superphosphate manufacturers in South Australia. A plant to make sulphate of ammonia (about 55,000 tons a year) is in course of erection at Risdon, and with full production the company will require all the acid available to it other than the small supply to other users in Tasmania. The company has announced its intention to eventually carry out the roasting at Risdon of all zinc concentrate available to it, eliminating roasting and acid making on its behalf on the mainland.)

COPPER (and Associated Silver, Gold and Other Metals): Four establishments, four companies. (For comment on industry and company relationships between the companies named below and between those companies and other companies engaged in mining, smelting, refining activities, or making of finished shapes, see the statement "Company Organisation and Association Within the Ferrous and Non-Ferrous Metals Industries in Australia" at the close of this Part.)

The Electrolytic Refining & Smelting Co. of Australia Pty. Ltd., Port Kembla, N.S.W., is the only customs smelter and refiner of copper-bearing materials in Australia. (The other electrolytic smelter/refiner treats only its own ores—see below.) The E.R. & S. Co. receives copper concentrate principally from two of the larger mining companies, ores con-

REFINED COPPER: Cathode copper; wire-bars for electrical and communication wires manufacture; ingot bars for brasses, bronzes, etc.; high-conductivity arsenical and phosphor copper billets for tube manufacture; high-conductivity and arsenical copper-cakes or slabs for plate, sheet and strip production. (Associated production of gold; silver (granulated or bar); platinum; palladium; selenium; tellurium; copper sulphate; bearing-metal alloys.)

taining copper, silver and gold from various small mines, blister copper with high gold content from Mount Morgan Ltd. (see "Blister Copper", below), blister copper from overseas, cathode copper from the other cathode-copper producer in Australia (see below), sludge residues containing copper, gold and silver from the zinc refinery at Risdon, Tas., and copper matte and speiss from the lead smelter/refinery at Port Pirie, S.A. Tank-house capacity is about 20,000 tons of copper a year. All but a small portion of the cathode copper produced in Australia is cast into market shapes at the Port Kembla smelter/refinery, which is also the largest producer of copper sulphate in Australia. From the treatment of slimes remaining in the tanks after the electrolytic deposition of copper cathode, gold and silver are recovered to substantial value, platinum and palladium are minor by-products, selenium is also recovered (at present the only source of refined selenium in Australia), and some tellurium is produced from time to time. The company is prescribed in regulations relating to the unwrought gold selling and buying provisions of the Banking Act 1945 (Commonwealth) and can thus buy virgin gold in unlimited quantities on behalf of the Commonwealth Bank, to which the gold must eventually be delivered; the company delivers the gold in fine gold form. The company also purchases on its own behalf offerings of wrought gold, and sweepings, residues, etc., containing precious metals, including low-grade residues of other refiners of precious metals in ore, bullion and/or wastes. The company also produces anti-friction bearing alloys. **Mt. Lyell Mining and Railway Co. Ltd.,** Queenstown, Tas., smelts and refines the copper concentrate from its own mines. Tank-house capacity is 13,000 tons a year. Other than a small amount of cathode copper sold direct to a fabricator (Austral Bronze Pty. Ltd., at its Hobart, Tas., factory), all the Mt. Lyell production of cathode copper is sent to the Port Kembla refinery (see above) for casting. The tank slimes are also sent to Port Kembla for treatment. Copper sulphate is steadily produced for Tasmanian consumption. By-product pyrite from the company's concentrate plant is sent to a mainland chemical-fertiliser plant of an associated company for sulphuric-acid manufacture. The company operates about 22 miles of common-carrier railway between its smelter/refinery and shipping port, and also has a hydro-electric power station supplying portion of its power requirements.

Mount Morgan Ltd., at Mt. Morgan, Queensland, smelts copper concentrate from its mine and also copper concentrate and ores purchased from some other mining companies in Queensland. The blister produced, which contains the high gold content and the silver of the Mt. Morgan ore, is all sent to the refinery of The Electrolytic Refining and Smelting Co. of Australia Pty. Ltd., Port Kembla, N.S.W. (see above), for conversion to cathode copper and refined gold and silver; the copper is treated there on toll, and the gold is purchased by E.R. & S. and sold to the Commonwealth Bank. (The greater part of revenue of the Mount Morgan mine is from gold.) **Mt. Isa Mines Ltd.,** at Mt. Isa, Qld., produced blister copper during

BLISTER COPPER.

the 1939-45 War, from ore gained from the copper ore-body in its mine. (Mt. Isa mine is at present principally concerned with mining and processing of ore from the lead-zinc ore-body in its mine—see "Lead", above.) The company has nearly completed the erection of a concentrate mill and smelter for copper separate from the lead-zinc mill and lead smelter, and expects to be producing by early 1953. Blister will be forwarded to the refinery at Port Kembla, N.S.W.

TIN: Two companies smelt practically all the Australian output of tin concentrate (imports and exports of tin concentrate are negligible), and one company recovers tin by de-tinning.

O. T. Lempriere & Co. Ltd. has its smelter at Sydney. The company also produces bismuth metal from Australian mixed concentrates and imported ore (an associated company produces bismuth salts from specified metal prepared by Lempriere's), and is the only producer in Australia of antimony metal and compounds, from Australian and imported ores. (The company also makes tin chemical compounds, tin metal powder, antimony chemical compounds, elemental selenium and selenium dioxide, anti-friction bearing metals, type metals, tube-bending metal, gunmetals and special bronzes, solders (soft sticks and wire of tin; powdered; cored; silver), tin anodes, tinning fluxes, brazing alloys; and a subsidiary company makes diamond tools and cast diamond-bits.) **The British Metal Corporation (Australia) Pty. Ltd.** (a subsidiary company of The British Metal Corp. Ltd., which has metal interests in the U.K., Malaya, India, Ceylon, South Africa and U.S.A.) has its smelter at Sydney, N.S.W. The company also produces bismuth metal from mixed concentrate and imported ore. **Electro-Chemical Metal Refining Co. Pty. Ltd.**, Sydney, N.S.W., recovers tin from tinned steel sheet scrap. (The company is a subsidiary company of Albert G. Sims Ltd., scrap-metal refiners and dealers. The parent company is establishing a second detinning plant, located at Melbourne, Vic., and will use at that plant the Metal and Thermite Corporation (U.S.A.) detinning process, for which it has the Australian licence.)

ALUMINIUM: The metal is not made in Australia. A plant for metal production is now being erected at Bell Bay, Tas. The Australian Aluminium Production Commission, a joint authority of the Commonwealth and Tasmanian Governments, is erecting the plant and will operate it. (The British Aluminium Co. Ltd., has agreed to act as technical consultants for an initial period of ten years.) Production is expected to begin in late 1954, using imported high-grade bauxite at first and gradually blending in the lower-grade Australian bauxites until the plant is proved capable of working entirely on Australian bauxite.

SPECIFICATION ALLOYING OF METALS FOR BEARINGS, TYPE, STEREOS, TIN SOLDERS, DIECASTING: About 35 manufacturers of BEARING METALS and about 30 manufacturers of TYPE and STEREO metals; about 17 of the manufacturers alloy both types of metals. **TIN SOLDERS** are mainly made by several alloyers, including, as a major producer, one of the tin smelters. Most alloyers can also provide specification BRASSES for diecasting. Manufacturers in the alloying activity are usually general dealers in and remelters of non-ferrous scrap and drosses (see "Remelt of Base Non-ferrous Scrap", below) and are mostly confined to the activity, notable exceptions being a tin smelter, a copper refiner, a non-ferrous rolling and extrusion company, a company group also making sintered bearings, dental supplies and refining and fabricating precious metals, and a company also operating a lead mill. **ZINC-BASED DIECASTING ALLOYS** are made by two companies only; the principal manufacturer is the only refiner in Australia of zinc from concentrate; the other manufacturer is also engaged in making sintered bearings, dental supplies and refining and fabricating of precious metals. **ALUMINIUM DIECASTING ALLOYS** are made mainly by one manufacturer, the principal manufacturer in Australia of aluminium finished shapes.

REMELT OF BASE NON-FERROUS SCRAP.

About 45 companies or businesses, practically all operated by dealers in scrap metals. A few of the larger companies have establishments in two or more States. Specification casting alloys in copper and aluminium are prepared by two companies. Useful secondary casting alloys are produced by several companies. Scrap is also reclaimed in considerable quantity at non-ferrous foundries, where it is used in non-specification and low-test castings.

CASTING MATERIAL FROM NON-FERROUS SCRAP: Brass, gunmetal, zinc, copper, aluminium and aluminium alloy, lead.

MINOR AND RARER INDUSTRIAL METALS: The smelting and refining in Australia of metals other than iron, lead, zinc, copper, tin and gold is very limited. (Silver is gained as a consequence of smelting and refining of lead, zinc, copper and gold.)

Antimony and Bismuth are the only other metals smelted and refined as the prime purpose of processing; both Australian and imported ores and/or concentrates are used. Antimony metal and compounds are produced only by O. T. Lempriere & Co. Ltd., Sydney, N.S.W. Bismuth metal is produced by Lempriere's and by The British Metal Corporation (Australia) Pty. Ltd., Sydney, N.S.W. (The smelting and refining activities of both companies are mainly concerned with tin—see "Tin", above.)

Metallic Cadmium is a by-product of zinc refining (Risdon) and lead smelting and refining (Port Pirie).

Cobalt Oxide (65% Co) is a by-product of zinc refining (Risdon).

Tellurium, when required, is recovered at the copper refinery at Port Kembla. (**Selenium**, a metalloid, is regularly produced at the copper refinery.)

Tungsten Metal Powder (for use in manufacture of ferro-tungsten, tungsten-carbide, etc.) is produced in Australia only by The Broken Hill Proprietary Co. Ltd., at its Newcastle iron and steel works. The raw material is wolframite, of Australian origin, processed to tungstic acid, which in turn is calcined to oxide, the oxide being reduced to the metal powder. (The powder is made into sintered carbide products by The B.H.P. Co. Ltd., and is also sold as powder.) Manganese and chromium ores, manganiferous iron-ores, and concentrates of molybdenite, wolframite, zircon and rutile, are utilised in Australia for manufacture of ferro alloys for special steels.

PRECIOUS METALS: The goldmining industry in Australia is mainly separate in company relationship from other mining industries, but silver production in Australia is almost entirely within the lead-zinc-silver mining, smelting and refining industry.

New Gold: All GOLD BULLION (that is, not from base-metal refining) produced in Australia, Papua and New Guinea, about 90 per cent. of the total gold yield, is refined in Australia. With certain exceptions (for example, goldware, new or old) the buying and selling of gold is controlled by the Commonwealth Bank as provided in Part IV of the Banking Act 1945 (Commonwealth); in Victoria and Western Australia there are also State Acts controlling dealing in all types of gold. In terms of Part IV of the Banking Act 1945 all newly-won gold must be ultimately sold by producers to the Commonwealth Bank, and the practice is for this gold to be delivered to the Bank in refined condition mainly through four refiners—the Royal Mint, Melbourne, Vic., the Royal Mint, Perth, W.A., The Electrolytic Refining and Smelting Co. of Australia Pty. Ltd., Port Kembla, N.S.W. (see "Copper", previously), and Garrett, Davidson and Matthey Pty. Ltd., Sydney, N.S.W. (refiners, alloyers and fabricators of precious metals). Two small companies are authorised to buy and refine virgin gold in small parcels only, and must within one month sell the gold, unrefined or refined, to one of the Royal Mints. In order to facilitate the distribution of manufacturing gold to industry several companies have been appointed "subsidiary" sellers and authorised to sell gold which has first been purchased by them from either of the three main refiners, which can also sell gold direct to fabricators. The Royal Mints refine practically all the bullion produced in southern and western Australia. Bullion from Papua and New Guinea and north-eastern Australia is practically all refined by Garrett, Davidson and Matthey Pty. Ltd. (Since late 1951 that company has been refining, on fee, bullion from the Emperor and Loloma mines in Fiji, for export as "premium" gold for sale on the free international market.) — The remaining 10 per cent. of the Australian gold yield is secured from GOLD-BEARING RESIDUES FROM BASE-METAL REFINERIES. The refineries are at Port Kembla, N.S.W., and Port Pirie, S.A. Port Kembla recovers from anode slimes (its own and Mt. Lyell's—see "Copper", previously) the gold, silver, platinum, palladium, content of copper ores from Mt. Morgan, Mt. Lyell and various small mines, and of zinc concentrate from Broken Hill mines and Read-Rosebery mines refined in Australia at the zinc refinery, Risdon, Tas. Recovery at Port Pirie (see "Lead", previously) is mainly of the silver and gold content of all the lead concentrate from the Broken Hill mines.

New Silver: Most of the production of refined silver in Australia is at the lead smelter/refinery at Port Pirie, S.A. (see "Lead", previously), recovered from all the lead concentrate from Broken Hill mines. A small part of production is obtained from the anode slimes (including the silver content of residues from refining activities at Risdon and Mt. Lyell) at the copper refinery, Port Kembla, and from gold bullion and silver bullion refined at the two branches of the Royal Mint, by Garrett, Davidson and Matthey Pty. Ltd., Sydney, N.S.W., and, on occasions, by other precious-metals refining companies. (About one-third of the silver mined in Australia is exported in lead bullion and concentrates of lead, zinc, copper.)

Platinum and Palladium: Both of these metals are obtained in very small annual quantity as a by-product in the course of gold and silver recovery from tank slimes at the copper refinery, Port Kembla, N.S.W.

(**Osmium and Iridium** in the natural alloy of osmiridium is secured from prospecting activities in Tasmania, but the alloy is not refined in Australia.)

Recovery of Precious Metals: About seven companies or businesses (including all companies included in "New Gold", above) are permitted under State Acts controlling gold buying, selling and treating to buy and refine wrought gold and jewellers' wastes, etc., and to sell the gold so secured for bona fide manufacturing purposes. The Royal Mints (which are exempt from the State Acts and do not require a licence) buy jewellers' wastes, photographic platemaker's wastes, etc., offered. Most of the wastes are refined by the companies, and, mostly on fee, the refined metals being returned to the manufacturing jeweller, etc. One refiner (the principal copper refinery in Australia) buys outright the wrought articles, sweepings, etc., offered, and also purchases the low-grades residues of other refiners for processing within its recovery system (see "Copper", earlier this Part). Three of the licensed refiners are also fabricators of precious metals, two of them specialists and the other also concerned with base-metals and dental supplies (see also "Finished Shapes—Precious Metals", later this Part). The remaining three licensed refiners are metallurgical processors, one being a specialist, one being concerned also with non-precious metals (and through an associate company with manufacture of glasspaper and emerycloth), and one being also engaged as an analyst.

Finished Shapes (or Forms) of Non-Ferrous Metals and Alloys

In 1949-50 there were 10 and in 1948-49 21 establishments wholly or mainly engaged in one or more of the activities of rolling, extrusion, drawing, of non-ferrous metals and alloys to finished shapes (or forms)—sheet, strip, foil, rod (or bar), shafting, section, wire, tubing. Some of the manufacturers also provide unfinished or intermediate shapes such as anodes, foundry ingot, forging stock. The employment size of the 21 establishments in 1948-49 was as follows (but see footnote)—

	Up to 20 Employees		21-50 Employees		51-100 Employees		Over 100 Employees		Total
	est.	empl.	est.	empl.	est.	empl.	est.	empl.	est. empl.
Non-ferrous rolling, extrusion, etc. . .	1	15	1	50	3	194	8	3,410	13 3,669
Lead mills (a)	6	48	4	122	—	—	—	—	10 170
Totals (a)	7	63	5	172	3	194	8	3,410	23 3,839

(a) Includes two establishments concerned with collapsible-tube manufacturing and not otherwise engaged in non-ferrous rolling, extrusion, drawing. The establishments are probably in the 21-50 group.

The greater part of output of finished non-ferrous shapes is produced by three companies, all of which are associates of non-ferrous mining and smelting/refining companies operating in Australia. See the statement "Company Organisation and Association Within the Ferrous and Non-Ferrous Metals Industries in Australia", at the close of this Part.

COPPER, BRASSES, BRONZES, GILDING METAL, NICKEL-SILVER, ALUMINIUM: Mainly at fourteen establishments, by eight companies and two Commonwealth Ammunition Factories—

Metal Manufactures Ltd., Port Kembla, N.S.W., and Maribyrnong, Vic., makes copper and cadmium-copper wire and rolled rod; brass rolled rod; trolley wire, round and grooved; bare copper and brass strip; copper, brass and bronze tubing; spun-cast hollows and solids for bearings; (and stranded copper conductor, steel-cored aluminium conductor, cotton-, paper-, silk-, rayon-, and glass-covered wire and strip, braided aerial cable, plastics-covered aerial cable). The company is the only maker in Australia of copper, brass and bronze tubing, trolley wire (and of steel-cored aluminium conductor), copper rod, and is the only drawer of copper wire from the wire-bar stage. The Port Kembla plant is engaged in all the company's activities. The Maribyrnong plant is engaged in the manufacture of wire (from rod stage), copper stranded conductor, and copper and brass tubing.

Austral Bronze Pty. Ltd. (wholly-owned subsidiary company of Metal Manufactures Ltd.), Alexandria, N.S.W., Maribyrnong, Vic., Derwent Park, Tas., makes all the finished shapes and ingot material shown at the right except tubing; copper wire; trolley wire; aluminium sheet, strip, wire, busbar, forging and casting material. The company is concerned only with non-ferrous finished shapes (and some casting material). The Alexandria mill is equipped for all processes. The Maribyrnong mill is entirely an extrusion mill, including billet foundry. The Derwent Park mill is entirely a strip mill, including foundry, and produces the company's entire output of strip.

G. E. Crane & Son Ltd., Concord and St. Mary's, N.S.W., roll copper sheet and aluminium sheet at its Concord factory, and aluminium foil (heavy gauges only) at the St. Mary's factory. (The company is a metal merchant, and manufacturer of plumbers' brassware, guttering, spouting, etc., and collapsible tubes. It also has capacity for lead rolling and extrusion.)

Australian Aluminium Co. Pty. Ltd., Granville, N.S.W., operates the principal mill in Australia for making aluminium finished shapes. All the aluminium products shown above (at right) are made. The mill has a remelt section at which its own scrap and scrap from various sources is reclaimed to specification condition. (A Commonwealth Government-owned forging annexe equipped for making aircraft forgings is adjacent and is operated by the Company when required.)

The Commonwealth Government Ammunition Factories at Footscray, Vic., and Finsbury, S.A., make sheet, flat and coiled strip in brass, gilding metal, nickel-silver, and phosphor-bronze, for sale (through a trade distributor) when not given wholly to munitions activities. The establishments are normally a major supplier in Victoria and South Australia.

Metalex Pty. Ltd., Oakleigh, Vic., operates an extrusion mill. Products are rod and section in brass, naval brass, Muntz metal, manganese-bronze. Some wire drawing is done. (This company is the wholly-owned subsidiary company of the machinery and electrical-goods merchant company distributing non-ferrous sheet and strip produced at the Commonwealth Ammunition Factories.)

Brass Co. of Australia Pty. Ltd., Maribyrnong, Vic., operates an extrusion mill making rod and section in brass, naval brass, manganese-bronze, Muntz metal. Some wire drawing is done.

Mylton's Ltd., South Melbourne, Vic., operates a nickel-silver sheet and strip mill integrated with one of the company's principal activities—manufacture of nickel-silver flatware (spoons, forks, etc.), electroplated and stainless nickel-silver. When available, surplus mill production is sold to other nickel-silver

FINISHED SHAPES and other material produced, in wide range of finishes, dimensions, properties, hardness, temper, including to special requirements—

Copper (including cadmium, arsenical, deoxidised): Sheet for roofing, guttering, etc., tanks, cylinders, boilers and other fabricated products, gold amalgamating plates. Marine sheathing. Flat and coiled strip. Tubing. Rolled and drawn rod. Busbar, commutator and pantograph bar, switchgear contact shapes, high-conductivity rod and strip. Bare wire. Trolley wire. Extruded rod, section. Anodes.

Brasses: Commercial brass sheet, coiled strip, extruded and drawn rod (including leaded), section. Wire. Tubing. Anodes. Casting ingot. Naval brass and Muntz's metal in sheet, drawn and extruded rod, marine sheathing, tubing, diaphragm plate.

Bronzes: Cusilman bronze and phosphor-bronze in sheet, flat and coiled strip. Aluminium-bronze in rod, shafting, casting ingot. Manganese-bronze in rod, section, casting ingot. Architectural bronze in extruded section.

Gilding metal in sheet, coiled strip, wire.

Nickel-silver in sheet, flat and coiled strip.

Aluminium, plain and alloy of wide range: Sheet, flat and coiled strip. Thick foil. Plate slab. Extruded rod, section. Tubing. Wire. Busbar. Forging and casting material. Hardeners.

ware manufacturers. **Rodd (Aust.) Ltd.**, St. Kilda, Vic., manufacturers of jewellery, electroplated nickel-silver flatware, sheffield plate and watchcases, operates a small foundry and rolling mill for nickel-silver strip (and strip and rod in precious metals) for use in its own manufacturing activities. **Glover & Goode Pty. Ltd.**, West Melbourne, Vic. (see also "Precious Metals", later this Part) will roll down when required customers' brass and gilding metal sheet and strip to fine and very fine gauges. A few companies with considerable brass rod and section requirements operate small extruding plants within their establishments, mainly for own requirements of rod and section and securing maximum return from scrap and swarf from manufacturing operations.

ZINC: Three establishments, three companies—

Century Storage Battery Co. Ltd., Sydney, N.S.W., one of the largest manufacturers of storage batteries in Australia (and self-contained in that activity), also operates a zinc-rolling mill. Process-engravers' plate is the principal zinc product, for export as well as for sale in Australia. Lithographic plates are a minor item, and small in area (large litho plates are not made in Australia). Zinc strip and zinc block are made. **Metal & Ores Pty. Ltd.**, N.S.W. (wholly-owned subsidiary company of Eveready Australia Ltd., dry-cell battery makers, and itself associated with the overseas company of similar name), operates the largest zinc strip mill in Australia, producing coils and billets for general sale. Battery strip is made for the parent company and another dry-cell battery maker. **General Dry Batteries (A/asia) Pty. Ltd.**, Melbourne, Vic., subsidiary company of one of the largest manufacturers of radios and electronic apparatus in Australia (and indirectly the only manufacturer of acetylene black in Australia), operates a plant for manufacture of dry-cell batteries. The company begins with ingot zinc, rolls its strip requirements, and makes the dry-cell battery cans by impact extrusion, the only maker of such seamless cans in Australia. Flat and coiled zinc strip is supplied to industry.

FINISHED SHAPES: Process-engravers' plate; lithographic plates; zinc strip in flat and coil, including battery strip; zinc blocks; seamless cans.

LEAD: Lead shapes and/or products (not including battery plates) are made by probably not less than 15 manufacturers in Australia. In 1949-50 there were 10 establishments wholly or mainly engaged as lead mills (at least two of which were engaged only in collapsible-tube manufacture) and in 1948-49 10 establishments. Of the 1948-49 establishments, 4 each employed up to 10 persons, 2 each from 11 to 20 persons, 4 each from 21 to 50 persons; the latter 4 establishments employed 122 persons out of the group total of 170 persons. (In 1948-49, an establishment, or establishments, in Queensland classified as being wholly or mainly as lead mills was or were included in the sub-class "Other Metal Works".) The greater part of production of finished shapes and of builders' lead products would be from about seven establishments—three in New South Wales, three in Victoria, one in Queensland. Four of those establishments are operated by companies or businesses concerned only with manufacture of lead shapes; one of these companies is the only manufacturer in Australia of lead shot, and another is also engaged in lead covering of electrical cables. Three of the largest lead mills are operated by two companies (one with one establishment in Victoria and another in New South Wales) which are also substantial manufacturers of plumbers' brassware, sewerage fittings and related products. (None of the companies operating the larger of the lead mills is associated in company organisation with lead-refining interests in Australia.) Impact extrusion of lead for collapsible tubes and metallic capsules is done by six manufacturers rolling their own strip. Collapsible tubes are made by four companies. One is a leading diecaster and plastics moulder and also makes builders' hardware, spray-irrigation systems; one is principally engaged in rolling of copper and aluminium sheet and in making plumbers' brassware and builders' hardware (and has capacity for rolling and extrusion of lead finished shapes); one is mainly a canister maker, of wide range of printed containers of tinplate, etc.; one is mainly a printer, box and carton maker, tinplate printer and canister maker, owned by the leading tobacco-products group in Australia. There are two specialist makers of metallic capsules of lead alloys mainly for the wine industry; one of the makers is a subsidiary company of a U.K. company engaged in the same activity.

FINISHED SHAPES: Sheet, pipe, wire, strip, plate, shot, wool.

PRODUCTS: Traps, castings, washers, flushpipes, tin-lined pipes; collapsible tubes—lead, lead alloy, tin-lined, tin; metallic capsules; sinkers.

TIN: Tin foil is made as a dental supply by one company in Australia, the company being a leading manufacturer of dental supplies and also engaged in refining and alloying of base metals and precious metals, and manufacture of sintered bearings.

PRECIOUS METALS: Shapes of precious metals are mainly supplied by four companies (and three of the companies can sell unfabricated gold for manufacturing purposes). One company, a specialist in the activity, is the largest precious-metals metallurgist in Australia (and is associated with a leading U.K. precious-metals refining and fabricating company). The company is authorised by the Commonwealth Bank to refine virgin gold in unlimited quantity (see "Precious Metals Refining", previously) and fabricates all the shapes and products shown at the right other than gold leaf and dental foil. It has three manufacturing establishments, two in Sydney and one in Melbourne. — One company is a specialist

FINISHED SHAPES: Standard gold in strip. Carat gold, gold alloy, silver, platinum, platinum alloys, palladium, and bi-metals (gold with silver, precious metals with base metals), in plate, sheet, strip, tubing, wire. Gold leaf and dental foil. Gold anodes. Silver anodes.

PRODUCTS: Solders in gold, silver, platinum, solder-filled wires (and rhodium plating solution, silver plating salts, gilding salts, silver salts). Low-temperature silver brazing alloys in strip, wire, rod, foil, wire rings, washers, special inserts (and fluxes for such alloys). Soft silver solders. Platinum crucibles, dishes and miscellaneous equipment and apparatus.

in the activity, and makes most of the shapes and products shown above at the right. It has one manufacturing establishment, at Sydney. — One company, with one establishment, at Melbourne, makes most of the shapes and products shown above at the right (and also makes dental supplies, sintered bearings, base-metal alloys). — All the foregoing companies are regularly engaged in treating wrought gold and jewellers' wastes (see "Precious Metals Refining", previously). — The largest manufacturer in Australia of wristwatch cases is also a principal supplier of bi-metalled plate, strip, rod and tubing, and of solder-filled wire and silver solders in various forms. — The largest jewellery manufacturing company in Australia prepares its own shapes (also selling to trade, particularly silver anodes); and several manufacturing jewellers have small rolling mills for plate, sheet and strip of small area. — There is one manufacturer of gold leaf, the production of which is the principal activity, with dental foil as an associated product. — (For manufacture of dental supplies by companies engaged in the precious-metals activity, see Chapter 12.)

FOUNDRIES, FERROUS AND NON-FERROUS; AND DIECASTING

FOUNDRIES

There are two sub-classes of official statistics that by title are specifically concerned with founding—"Foundries, Ferrous" and "Non-ferrous Metals: Founding, Casting, etc.". Official statistics refer only to such concerns as are registered foundries and whose major activity is the casting of metal, and also include in one group with non-ferrous foundries those establishments wholly or mainly engaged in non-ferrous forging and hot pressing, brassfinishing and coppersmithing. They do not include in most States numerous engineering and allied industries, Government workshops, etc., which have "captive" foundries, machine shops and patternmaking establishments attached to their main workshops, which may be manufacturing, assembling or constructing motor cars, heavy earthmoving equipment, railway rolling stock, coal mining machinery, etc. There are also, for example, certain companies in the chemicals, woolscouring and glass manufacturing groups which manufacture castings for maintenance as well as for general distribution. Official statistics of non-ferrous foundries do not include diecasting (which, as an activity, is included in the sub-class "Plant, Equipment and Machinery, including Machine Tools"). The statistics of ferrous foundries used in this study, apart from official statistics in tables at the close of this Chapter and for imports and exports statistics, were obtained in the course of a direct survey of the industry made in 1951 by the Division of Industrial Development.

FERROUS FOUNDRIES

The total number of ferrous foundries in Australia, including those that function as part of establishments engaged in general engineering and other metal-products manufacture, is about 418, employing 16,100 persons. Of that number of establishments about 35 are regularly producing steel castings (in addition to some grey-iron castings); and 402 are producing iron castings. About 50 iron foundries (including some foundries making both iron and steel castings) regularly produce castings of alloy iron and special iron. Most steel foundries regularly produce castings of alloy steels. The following table illustrates the numbers and types of foundries in each of the States—

	Jobbing and Repetition: IRON	Jobbing and Repetition: IRON and STEEL	Repetition: IRON	Jobbing: IRON	Jobbing: STEEL	Total
	no.	no.	no.	no.	no.	no.
New South Wales	49	7	31	47	5	139
Victoria	43	4	33	42	6	128
Queensland	21	2	10	12	1	46
South Australia	25	2	9	14	3	53
Western Australia	12	4	7	15	1	39
Tasmania	5	—	3	5	—	13
Totals	155	19	93	135	16	418
% of Total	31.7	4.5	22.3	32.3	3.8	100

CASTINGS in grey, alloy, malleable and patent iron; steel and steel alloy.

The majority of foundries are situated chiefly in or close to the major industrial centres of Sydney, Newcastle and Port Kembla, New South Wales; Melbourne, Geelong and Ballarat, Victoria; Brisbane, Queensland; Adelaide, South Australia; and Perth, Western Australia. There are, however, large and long-established foundries, part of significant engineering establishments, at several important provincial towns distant from metropolitan areas.

The bulk of castings produced in Australia are made by about 50 large companies, the major activities of which are other than founding, for example, iron and steel works, railways and other Government workshops, general engineering works, and manufacturers of agricultural machinery, stoves, ovens, baths, basins, motor vehicles, tractors, earthmoving equipment, and pipe. About 80 per cent. of foundries in Australia, both independent or part of an engineering establishment, are quite small, each producing less than 500 tons of castings a year.

There are 19 foundries operating under "Meehanite" methods: 4 in New South Wales, 3 in Victoria, 2 in Queensland, 3 in South Australia, 2 in Western Australia and 5 in Tasmania. A few foundries, mainly in New South Wales and Victoria, produce precision castings. A new company has recently been formed, in Victoria, to produce for the first time in Australia, pre-

cision investment castings. Licences have been issued by the patent right holders overseas to three foundries in Australia to produce spheroidal graphite iron (nodular iron)—two in New South Wales, and one in South Australia; to date only experimental quantities of nodular iron have been produced.

NON-FERROUS FOUNDRIES

There are, probably, not less than 380 non-ferrous foundries in Australia, including those which are a section of an establishment the major activity of which is not founding. The foundries of good standing are capable of producing non-ferrous alloy castings to special specifications when required. One of the largest of the non-ferrous foundries is that of the principal manufacturer of military aircraft in Australia. A few large non-ferrous foundries are also equipped for hot pressing for plumbers' and builders' hardware, brassware and other hardware. Numerous firms in the metal-products manufacturing and particularly the heavy-engineering industries conduct small ferrous and non-ferrous foundries principally for maintenance purposes. Seventy-five per cent. of the industry, in number and capacity, exists in New South Wales and Victoria, while South Australian foundries, though fewer in number, have considerably greater productive capacity proportionately than any of the other States. In view of the large quantities (up to 50,000 tons a year) of secondary metal used by non-ferrous foundries, well-organised groups of remelters with adequate furnace capacity exist in each of the States' capitals. These organisations collect, melt and re-alloy to usable specifications, copper, brass, aluminium, bronze, and other alloy constituents such as zinc, tin, antimony, lead, etc.

CASTINGS: Brass; gunmetal; Admiralty bronzes; manganese-phosphor-, and aluminium-bronzes; aluminium and aluminium alloy.

DIECASTING OF ARTICLES FOR OTHER MANUFACTURERS

There are about sixty diecasting companies in Australia, half of which are very small and employ not more than half-a-dozen operators. The output of these small companies is limited mostly to the manufacture of zinc-based diecastings of a general nature. The balance of the industry, some thirty or more companies, produce about 90 per cent. of the diecastings made in Australia in aluminium alloy, aluminium bronze, and zinc-based diecasting alloy. Five of the latter employ over 100 persons each, while about ten employ over 50 persons each. The remainder are small to medium sized companies employing from ten to about 30 persons each.

The production of castings on a general jobbing, repetition and specialist basis is widespread, most companies being prepared, within the limits of their machines, to make diecastings from a few ounces to many pounds in weight. New South Wales and Victoria produce the bulk of the castings made, and zinc-base diecasting alloy is the chief material used. Some of the major diecasting companies in Australia are enumerated below.

Efco Manufacturing Co. Pty. Ltd., Sydney, N.S.W., makes diecast components for refrigerators, radio receivers, electrical switchgear components, builders' hardware, etc., as well as a wide range of diecast components to order. This company has both gravity and pressure moulding machines. — **R. H. Lawrenson Pty. Ltd.**, Sydney, N.S.W., makes diecast components for internal-combustion engines, railway-carriage fittings, automobile accessory parts, household utensils, screwed plugs for oil drums, electrical and radio parts, electric-motor bodies, parts for washing machines, vacuum cleaners, etc. In addition this company will make, to order, any diecast component, in a weight range from one-tenth of an ounce to 20 lbs. each. — **C. C. Die Castings Ltd.**, Sydney, N.S.W. (a subsidiary of C. C. Engineering Industries Ltd.), as well as making diecast components for its parent company, does jobbing work for a wide range of industries. Products made include diecast components for builders' hardware; carpenters' handtools; components for vacuum cleaners, electric motors, electricity meters, washing machines, lawn mowers, automotive parts, etc. This company has pressure-casting machines of maximum weight capacity from 8 ozs. to 18 lbs. — **Die Casters Ltd.**, Melbourne, Vic., makes a wide range of diecast components, including builders' hardware, motor-car and refrigerator fittings and parts. This company is also one of the largest plastics-products manufacturers in Australia (see Chapter 7). — **Huckson Diecasting Pty. Ltd.**, Melbourne, Vic., makes a range of diecastings, particularly for builders' hardware. — **Victorian Diemoulders Pty. Ltd.**, Geelong, Vic., makes diecast components, including motor horns, drum bungs, automobile door and boot catches, neckrings and caps, pressure gauges, oil caps, petrol faucets, oil valves and toy sewing machines. — **Pope Products Ltd.**, Adelaide, S.A., makes diecastings principally for its own extensive range of products, which includes washing machines, builders' hardware, plumbers' brassware, refrigeration hardware, handtools, etc.

FORGING, FERROUS AND NON-FERROUS; AND BLACKSMITHING

Forge-shops mainly concerned with ferrous forgings are grouped in official statistics with smelting, converting, etc., of iron and steel and manufacture of intermediate and finished steel shapes. Forge-shops mainly concerned with non-ferrous forgings and hot pressing of brass, etc., are grouped in official statistics with non-ferrous foundries. Most of the forging capacity in Australia is operated by general-engineering plants or by manufacturers of heavy equipment and machinery such as motor vehicles, agricultural implements, marine engines, railway equipment and rolling stock or by shipbuilding works, etc. These activities are treated elsewhere in this study, but forging is specifically treated here apart from the other activities of plants with forging capacity.

HEAVY PRESS FORGING: Heavy press forgings are comprised mainly of components for heavy machinery, ships' engines, ships' propeller shafts, ordnance, high-pressure air vessels, etc. There are ten establishments in Australia with heavy steam or hydraulic press-forging capacity, ranging from about 6 presses of 500 tons to one (not yet completely installed) of 5,000 tons. In all, there are perhaps 20 to 25 heavy forging presses in operation. The following are the ten organisations with heavy press-forging capacity—

METALS, SHAPES, PIPES, TUBES, CASTINGS, FORGINGS

Commonwealth Steel Co. Ltd., Newcastle, N.S.W. (for a description of the activities of this company, see earlier this Part), has forging presses which range in capacity up to 2,000 tons. The 5,000 ton press referred to above is being installed. (This company also has power hammers—see later.) The **Broken Hill Proprietary Co. Ltd.** has heavy forging presses at its Whyalla, S.A., works. Capacity of the presses ranges up to 2,000 tons. (This company also has power hammers—see later.) The **Commonwealth Ordnance Factory** at Maribyrnong, Vic., has heavy-forging capacity, with presses of up to 1,500 tons. (This factory also has drop stamps and power hammers—see later.) **Thompsons, Castlemaine Ltd.**, Castlemaine, Vic., a general heavy-engineering company, has heavy forging presses of up to 1,200 tons' capacity. (This company also has power hammers—see later.) **Australian Iron and Steel Ltd.**, Port Kembla, N.S.W., has a large forging press. (For a description of the activities of this company, see earlier this Part.) **Walkers Ltd.**, a shipbuilding and marine-engine works, at Maryborough, Qld., has heavy-forging capacity (as well as drop stamps and power hammers—see later). The **Queensland and New South Wales Government Railways Departments** both have heavy forging presses (and drop stamps and power hammers). Two other companies, **Melbourne Iron and Steel Mills Pty. Ltd.**, a small steel works at Melbourne, Victoria, and **Hadfields Ltd.**, a large general-engineering works at Sydney, N.S.W., have a heavy forging press each. (Melbourne Iron and Steel Mills Pty. Ltd. also has power hammers—see later.)

DROP STAMPING: There are about 45 establishments in Australia with one or more drop stamps, producing forged components in substantial quantities for use in the manufacture of motor vehicles, agricultural machinery, internal-combustion engines, earthmoving equipment, wheels, etc. Of these 45 establishments, 30 use their drop-stamping capacity practically solely for their own production; the other 15 also do drop-stamping work for other firms (and 9 of these 15 also do smithing types for outside firms). (Of the total 45 establishments, about 32 also have power hammers installed (see later, but all but the 9 mentioned above use this capacity only for their own work.) Most of these establishments concentrate mainly on ferrous forgings, although there are about 3 small firms, and two of the larger firms, mentioned below, which do a considerable amount of non-ferrous forging. The 45 establishments (several State and Commonwealth organisations are included) operate, in all, more than 130 drop stamps and several more are on order or being installed. More than 90 of these stamps are of less than 1-ton capacity. The following classification gives an indication of capacity ranges of drop stamps in use: Up to 5 cwt., 9; 6 cwt. to 10 cwt., 38; 11 cwt. to 15 cwt., 33; 16 cwt. to 1 ton, 26; 1 ton to 5 tons, 19; over 5 tons, 4; total 129 drop stamps. (There are a number of drop stamps, of which capacity is not known, not included in this classification.) In addition to the above, three of the stamps now being installed are large—over 200 yard/tons. The 45 establishments are distributed between States as follows: Victoria, 17; New South Wales, 16; South Australia, 5; Queensland, 4; Tasmania, 2; Western Australia, 1; total establishments, 45. Twenty-seven of the establishments have 5 stamps or less each, most of the stamps being of less than 1 ton capacity. Some of the larger drop-stamping establishments are listed below—

The **Commonwealth Small Arms Factory** at Lithgow, N.S.W., has considerable drop-stamping capacity up to about 3½ tons. As well as its own production, it makes a very wide range of steel drop forgings, and some upset forgings, for industry generally. (It also has power hammers—see later.) **Australian Forge and Engineering Co. Pty. Ltd.**, a large forging and general-engineering company at Sydney, N.S.W., has a number of drop stamps, ranging in capacity from 5 cwt. up to 6 tons. A further large stamp is being installed. This company is the principal supplier of forgings for manufacture of motor vehicles, tractors, internal-combustion engines and earthmoving equipment, particularly ferrous forgings, although it is also the chief manufacturer of non-ferrous forgings, particularly in aluminium for the aircraft industry. (This company also has power hammers—see later.) The **Commonwealth Ordnance Factories** at Maribyrnong and at Bendigo, Vic., have drop-stamping capacity up to about 5 tons, and two other large stamps are being installed. Practically all of this capacity is concentrated on the factories' own production. (Maribyrnong also has power hammers—see later.) The **Government Railways Departments** in all States have drop-stamping capacity, but in all cases this is concentrated on the Departments' own work. (All have power-hammer capacity as well—see later.) The **New South Wales Tramways Workshops** also have drop stamps, up to about 17 cwt. capacity (and power hammers), but do only their own work. The **State Electricity Commission of Victoria** has drop-stamping capacity at Richmond (and a number of power hammers at Kiewa and Yallourn, Vic.). Two large agricultural-implement manufacturers, **H. V. McKay-Massey Harris Pty. Ltd.**, Sunshine, Vic., and **International Harvester Co. of Australia Pty. Ltd.**, Dandenong, Vic., have drop stamps of up to about 1 ton capacity, but use practically all this capacity for their own manufactures. **Kirkstall Repco Ltd.**, a recently-formed company owned jointly by a large United Kingdom forging company and by an Australian motor parts and accessories manufacturing considerable drop-stamping capacity. (This company also has power hammers—see later.) **Henderson's Federal Spring Works Ltd.**, Melbourne, Vic., one of the largest of spring manufacturers in Australia, has a number of drop stamps, ranging in capacity from 8 cwt. to 2 tons (the company also has power hammers) and makes forgings for outside firms as well as for its own use. **Miller Cyclone Forgings Pty. Ltd.**, a forging and knife manufacturing company at Melbourne, Vic., has a number of drop stamps ranging in capacity up to about 1 ton (and also power hammers) and does drop (and smith) forging for outside firms as well as for its own production. **Australian Aluminium Co. Pty. Ltd.**, Granville, N.S.W., operates a Government-annexe with drop stamping capacity, which is used mainly for the company's non-ferrous forgings, particularly aluminium aircraft forgings. (This company also has power hammers—see later.) **Clyde Engineering Co. Ltd.**, Granville, N.S.W., has several drop stamps of up to about 1 ton capacity (as well as power hammers) and does forging work for the trade. **Duly and Hansford Ltd.**, Sydney, N.S.W., a motor-vehicle parts and accessories manufacturer, has a number of drop stamps. Most of this firm's capacity is concentrated on its own products. **Siddons Drop Forgings Ltd.**, Melbourne, Vic., one of the largest manufacturers in Australia of hand tools and specialising in forged spanners, has drop stamps of up to 7 cwt. capacity. **Hyltest Axe and Tool Pty. Ltd.**, Sydney, N.S.W. (a subsidiary of Australian Consolidated Industries Ltd.) has drop stamps of up to 1-ton capacity. This company is one of the largest manufacturers in Australia of forged axes, hatchets, hoes, adzes, picks, mattocks, hammers, chisels, bricklayers' bolsters, etc. **Metal Equipment Manufacturers Pty. Ltd.**, Sydney, N.S.W., has drop stamps up to 15-cwt. capacity, and is one of Australia's largest manufacturers of hammers, also making pliers, tinsnips, carpenters' planes, grass shears, pruning shears, etc. (This company also has capacity for hot-brass pressing—see later.)

SMITH FORGING: There are about 185 establishments in Australia which have steam or pneumatic power hammers for smith forging of ferrous and non-ferrous metal components and articles (32 of these also have drop-stamping plant; 7 also have heavy press-forging plant). The majority of these establishments use their forging capacity only for their own production; there would be only about 50 which normally also cater for outside firms. About 70 of the establishments are Commonwealth, State or municipal organisations, technical colleges, etc., which with about 2 exceptions, make forgings only for their own use. In all, these establishments have installed, or on order, about 350 steam or pneumatic power hammers, ranging in capacity

from 1 cwt. up to about 6 tons. Some 150 to 200 of these would be of between 5-cwt. and 10-cwt. capacity, and a further 90 to 100 are of less than 5-cwt. capacity. The following table indicates the distribution of power hammers according to capacity, as far as is known: 1 cwt., 20; 2 cwt., 21; 3 cwt., 51; 5 cwt., 77; 7 cwt., 26; 10 cwt., 52; 15 cwt., 20; 1 ton to 2½ tons, 20; 3 tons and over, 7; total, 294 power hammers. (In addition to the machines included in this table, there are a number on order but not yet installed, and perhaps 40 for which information on capacity is not available.) Of the total 185 establishments which have power hammers, 98 have only one machine installed. There are 9 other firms which have no power hammers installed, but which each have one on order, and one other establishment with two on order. Most of these establishments make forgings only for their own activities. No more than about 20 would normally make forgings for outside firms. A further 22 of the 185 establishments have only two power hammers each. About 10 of these do work for the trade, but the rest make forgings only for their own use. Most of the power hammers installed in the firms with only one or two power hammers are small, there being few of capacity greater than 5 cwt. The following list shows some of the larger smith-forging plants in Australia—

One of the largest smith-forging shops in Australia is that of the **Western Australian Government Railways** at Perth, which has numbers of power hammers ranging in capacity from 5 cwt. up to about 2½ tons. **Australian Forge and Engineering Co. Pty. Ltd.**, Granville, N.S.W., one of the largest drop-stamping companies (see above), has a number of power hammers ranging in capacity from 2 cwt. to 1½ tons. This company makes smith forgings for the trade as well as for its own use. **H. V. McKay-Massey Harris Pty. Ltd.**, Sunshine, Vic., a large agricultural-machinery manufacturer, has power hammers ranging from 2-cwt. to 5-cwt. capacity, and makes forgings for the trade as well as for its own products. This firm is also one of the larger drop-stamping companies—see above. **The Commonwealth Ordnance Factory** at Maribyrnong, Vic., has power hammers up to 15-cwt. capacity, but makes forgings only for its own use. **The Railways Departments of New South Wales, Victoria, Queensland, and South Australia** all have considerable power-hammer capacity, at various workshops, but do not make forgings for outside customers. **Cockatoo Docks and Engineering Co. Pty. Ltd.**, Sydney, N.S.W., has power hammers in capacities up to 6 tons, but uses this capacity normally only for its own production. **Australian Aluminium Co. Pty. Ltd.**, Granville, N.S.W., has power-hammer capacity, which is used, however, only for its own products. **The Broken Hill Proprietary Co. Ltd.** has power hammers of up to 30-cwt. capacity (and also drop stamps and heavy press-forging plant at Whyalla), but makes forgings mainly for its own use. **Tulloch Ltd.**, Sydney, N.S.W., a large general-engineering company which specialises in heavy steel fabrication (it does a considerable amount of work for the N.S.W. Government Railways) has a number of power hammers. **Commonwealth Steel Co. Ltd.**, Newcastle, N.S.W., has power hammers in capacities up to 6 tons, and makes forgings for the trade as well as for its own use. (This company also has heavy press-forging capacity—see above.) **Henderson's Federal Spring Works Ltd.**, Melbourne, Vic., has a number of power hammers, which are used both for the firm's own production and to make forgings for outside firms. (This company also has drop stamps—see above.) **Evans Deakin and Co. Ltd.**, Brisbane, Qld., a large shipbuilding and general-engineering firm, has power hammers of up to 30-cwt. capacity. **Perry Engineering Co. Ltd.**, Adelaide, S.A., is another firm which makes forgings for the trade; it has several power hammers of up to 3-tons capacity. **Hadfields (West Australia) 1934 Pty. Ltd.**, Bassendean, W.A., a steel founding and forging company, has power hammers from 5 to 12 cwt. capacity and caters for outside work. **The Colonial Sugar Refining Co. Ltd.**, Sydney, N.S.W., has power hammers up to 15-cwt. capacity, which, however, make forgings mainly for the company's own use. **Pioneer Spring Co. Ltd.**, Sydney, N.S.W., has power hammers from 5-cwt. to 10-cwt. capacity, and caters for the trade as well as making its own forgings.

HOT BRASS PRESSING: This method of producing brassware is allied to forging, and is mainly used in the manufacture of plumbers' brassware—gas and water fittings, sewerage fittings, taps, etc. There are seven principal firms in Australia with capacity for hot brass pressing—

G. E. Crane and Sons Ltd., Sydney, N.S.W., are a fairly large copper and aluminium rolling and fabricating firm also engaged in the manufacture of brass plumbers' and builders' hardware, etc., and collapsible tubes (lead-based). **John Danks and Son Pty. Ltd.**, Melbourne, Victoria, are manufacturers of a wide range of brass plumbers' and builders' fittings and hardware (lead and cast iron is also used), and of other products including windmills, animal feeding troughs, tank stands, pumps, valves, hose fittings, etc. **John McIlwraith Industries Ltd.**, Melbourne, Vic., is a large fabricator of lead products, also manufacturing plumbers' brassware, gas coppers, and engaged in lead rolling and extrusion. **Pope Products Ltd.**, Adelaide, S.A., is a large producer of a wide range of ferrous and non-ferrous metal products, including garden and hose fittings, lawn mowers, electric motors, irrigation systems, laundryware, washing machines, wringers, kitchenware, toys, refrigeration valves and fittings and gas appliances and fittings, and is engaged in brass and steel forging and extrusion of brass rod. **Metal Equipment Manufacturers Pty. Ltd.**, Sydney, N.S.W., one of the largest Australian manufacturers of hammers and other hand tools, has hot-brass pressing capacity (as well as drop-stamping capacity—see earlier). **K. G. Luke Pty. Ltd.**, Melbourne, Vic., are engaged in silversmithing, general engineering, hot brass pressing and hospital equipment manufacture. **Watson and Crane Pty. Ltd.**, Sydney, N.S.W., makes a wide range of plumbers' brassware. A few other establishments have one or two presses each.

BLACKSMITHING

Many large general-engineering establishments (particularly, for example, railways workshops and shipbuilding works) operate blacksmithing shops, mainly for their own products, but sometimes also taking in outside jobs. There are a number of specialist blacksmithing establishments, most of them small, widely spread throughout the Commonwealth. Products made include ornamental ironwork, wrought-iron gates, horseshoes, davits, fire-dogs, andirons, iron tyres, wrought-iron furniture, light fittings, fire-irons, firescreens, etc., and a wide range of specific items to order.

Organisation and Association of Major Companies within the Non-Ferrous and Ferrous Metals Industries in Australia

THE organisation and association of the major companies engaged in metal mining, smelting, refining and fabricating of finished shapes in Australia is one of confusion in general impressions of the average enquirer. Probably the commonest confused impression concerns companies usually called in Australia the "Collins House group", in that the group reputedly comprises ALL the major metals companies, non-ferrous and ferrous, in Australia. (The sobriquet arose many years ago because of the location at Collins House, Collins Street, Melbourne, Vic., of executive offices of most of the major non-ferrous mining companies, particularly in the earlier and more spectacular years of their development.)

The so-called "Collins House group" is in fact concerned only with non-ferrous metals companies, and those companies which for various reasons apparent in comment set out below can be considered as being a group do not comprise all the major non-ferrous metals companies in Australia. It is the mining companies operating at Broken Hill, N.S.W., and Read-Rosebery, Tas., the refining companies operating at Port Pirie, S.A., Risdon, Tas., and Port Kembla, N.S.W., and certain companies in non-ferrous metals fabricating, that can be considered to be a group, but each company has its own entity.

The exploitation of indigenous metals resources falls broadly into four industries (in historical sequence)—the gold industry; the silver-lead-zinc-copper industry; the iron and steel industry; and (rather recent) the rarer metals industry.

In its organisation the goldmining industry is mostly separate from the other industries. About 90 per cent. of the gold yield in Australia comes from goldmining proper (mainly in Western Australia); the production of gold bullion is essentially part of the goldmining activity and is not, in official statistics, a manufacturing activity as are smelting and/or refining of lead, zinc, copper and tin. The remainder of the gold yield is from base-metal refining, particularly of Mount Morgan blister copper. Both the non-ferrous and ferrous industries have company interests in the gold industry proper, but to a minor extent. Gold-industry companies engaged in mining in Australia have very little investment in manufacturing activities; but a very successful Australian company mining in Fiji, Loloma (Fiji) Gold Mines N.L., has in recent years acquired substantial shareholdings as investments in Australian manufacturing industries, principally motivated by taxation circumstances in Fiji and Australia.

The silver-lead-zinc-copper industry had its origins in mining at Broken Hill, western New South Wales (silver-lead-zinc); Mt. Lyell (gold-copper), Zeehan (silver-lead-zinc, and tin) and Read-Rosebery (lead-zinc-copper), western Tasmania; Mount Morgan, central coastal Queensland (gold-copper); and Mount Isa, western Queensland (lead-zinc, and copper). Later fields of significance, but much smaller, are at Captain's Flat, south-eastern New South Wales (lead-zinc-copper); and at Cobar, central New South Wales (gold and copper, mainly gold). There are several minor sources of base metals elsewhere throughout Australia. Mining interests operating at Broken Hill and Read-Rosebery are the core of the "Collins House" association. Those operating at Mt. Lyell, Mt. Morgan, Mt. Isa, Captain's Flat and Cobar are each sepa-

rate entities. (See later for further comment on non-ferrous company organisation and association.)

The ferrous metals industry, that is, iron and steel production, has no company association with the silver-lead-zinc-copper industry, and only minor association with the gold industry. The principal company in the ferrous industry, The Broken Hill Proprietary Co. Ltd., had its origin in 1885 in silver-lead-zinc mining at Broken Hill. In 1892 it purchased the lead smelter already established at Port Pirie (and now extended and operated by three Broken Hill non-ferrous companies). The B.H.P. Co. Ltd. entered into iron and steel production in 1913, and by 1939 had sold out entirely its interests in silver-lead-zinc mining, smelting and refining. (See later for details of organisation and association of major companies of the ferrous metals industry.)

The rarer metals industry became of importance only in recent years because of numerous scientific developments wherein certain of the metals used in only minute quantities have some pronounced virtue when used in metal alloys. In the alloy steels, molybdenum, tungsten, cobalt, zirconium, niobium, tantalum, etc., impart properties of toughness, resilience, increased melting point, and a weight/strength ratio unobtainable with normal carbon steels. In sintered form, titanium, tungsten carbides, etc., produce particularly hard metals for cutting tools. In electronics—radar, radio, television, X-ray equipment—infra-red photography, aerial-camera lenses, turbo-jet engines, and in atomic research and development, many of the rarer metals are essentials. Hence in addition to their peacetime usage there is considerable emphasis on stockpiling of ores and concentrates for defence purposes. The Broken Hill Proprietary Co. Ltd. processes wolframite to make tungsten powder, from which it makes tungsten-carbide die-nibs, tool-tips and other items. The B.H.P. Co. Ltd. also makes ferro-alloys for manufacture of special steels, using manganese, chromite, manganese iron-ore, molybdenite, zircon, rutile. The Consolidated Zinc Corporation Ltd., through its subsidiary company Titanium and Zirconium Industries Pty. Ltd., is a processor of beach sands for titanium and zirconium concentrates. Other than in these instances, there appears to be little association between the old-established major metals companies and the interests now developing the exploitation of resources of rarer metals.

An outline of the organisation and association of major companies within the base non-ferrous metals industry, and the iron and steel industry, is set out following.

THE NON-FERROUS METALS INDUSTRY

It is almost inevitable that the outcome of effective exploitation of rich indigenous resources of metals within a country rapidly expanding simultaneously in population, development of agricultural, pastoral and manufacturing resources, and living standards, should be that a substantial portion of the new capital wealth quickly gained from mining finds use in general investment within the country concerned.

Early development of Australia was hastened considerably by large gold yields over many years, a yield that is still significant, though much less than previously. The disposal of new capital so gained has been and remains largely the individual concern of shareholders, as returns are almost entirely distributed as dividends. (However, see comment on the Loloma mining company, Fiji, above.) In this way wide dispersal of capital and its investment occurred.

In contrast, a conspicuous aspect of non-ferrous metal mining in Australia is the extent—substantial in degree and effect—to which certain of the major mining and refining companies, while making large returns to shareholders, have also directly entered into investment in manufacturing industries.

Notable is the complete change of activity of The Broken Hill Proprietary Co. Ltd., the first of the Broken Hill mining companies, which towards the end of the life of its Broken Hill mine invested its reserves from silver-lead-zinc mining and refining in the

ferrous metals industry and is now entirely within that field and completely out of the silver-lead-zinc field from which it sprang.

Not many years went by before the non-ferrous mining companies had entered substantially into smelting and refining of mine concentrates and associated processing for sulphuric acid for chemical-fertiliser manufacture. One of the companies, with London headquarters, widened its similar interests within the United Kingdom. Following that phase and overlapping it was the entry into fabricating of market shapes of non-ferrous metals into finished shapes or forms—sheet, rod, wire, tubing, and so on. Then, again overlapping in sequence, was the entry of one of the fabricating companies into manufacture of electrical wires and cables (so successfully that associated companies have been formed in that field), and investment of substantial capital by one or more of the companies in major companies operating in the industries of chemicals, fertilisers, paper, paint, alloy steels, aluminium fabricating, military aircraft, rayon filament, electrical-appliance manufacture. To a lesser extent capital has been invested in gold mining and dredging, and search for minerals, including petroleum.

Organisation and relationship of the major non-ferrous mining companies in Australia, as at early 1952, can be stated in general summary as follows—

Companies Grouped by Various Associations With Each Other

Broken Hill South Ltd. and one subsidiary company—
Electrolytic Refining & Smelting Co. of Australia Pty. Ltd.

North Broken Hill Ltd.

The Consolidated Zinc Corporation Ltd. and several subsidiary companies (some of which also have subsidiary companies)—

Zinc Corporation Ltd. (which has three subsidiary prospecting companies, now virtually dormant).

Broken Hill Corporation Ltd.

Sulphide Corporation Ltd.

Consolidated Zinc Pty. Ltd., and subsidiary companies—

Heron's Creek Timber Mills Pty. Ltd.

Mines Consultants Pty. Ltd.

Southern Power Corporation Pty. Ltd.

Throwaway Bit Corporation Pty. Ltd.

Titanium & Zirconium Industries Pty. Ltd.

Four other subsidiary companies of either a development or service nature.

Imperial Smelting Corporation Ltd., U.K., and subsidiary and sub-subsidiary companies—

National Smelting Co. Ltd. (which has 9 manufacturing subsidiaries and 11 non-manufacturing subsidiaries).

New Broken Hill Consolidated Ltd.

Electrolytic Zinc Co. of Australasia Ltd.

— Unlike the other companies mining at Broken Hill, N.B.H.C. has no shareholding in the lead refinery at Port Pirie, or in other Australian industries. — Broken Hill South and North Broken Hill own Zeehan Mines Pty. Ltd. in equal share; the company is developing an exploratory mine on the Zeehan field, Tasmania.

Subsidiary Companies of Mining Companies: North Broken Hill, New Broken Hill Consolidated, and Electrolytic Zinc, each have no subsidiary operating companies. — Broken Hill South has the majority shareholding in Electrolytic Refining & Smelting Co. of Australia Pty. Ltd. (see later paragraph on investments). — Consolidated Zinc Corporation has a complex structure of subsidiary companies, some of which in turn have subsidiary companies. Zinc Corporation Ltd. is a mining and prospecting company. Broken Hill Corporation Ltd. is now a holding

Entity of Each Mining Company:

Broken Hill South, North Broken Hill, Zinc Corporation (C.Z.C.) and New Broken Hill Consolidated operate mines, one to each company, at Broken Hill. — B.H. South, North B.H. and Southern Power Corporation Pty. Ltd. (C.Z.C.) own Western N.S.W. Electric Power Pty. Ltd., which supplies the mines. — Electrolytic Zinc operates two mines at Read-Rosebery, and the zinc refinery at Risdon.

Investment by the above mining companies in one another is negligible except in three instances. — North B.H. has a small holding in C.Z.C. and a fairly large holding in E.Z. — B.H. South has a very small holding in North B.H., and a fairly large holding in E.Z. — Electrolytic Zinc has a not unsubstantial holding in C.Z.C. — The C.Z.C. does not now have investments in any other major mining company in Australia other than (through Broken Hill Corporation Ltd.) about one-third of the ordinary shareholdings of New Broken Hill Consolidated.

— Broken Hill South and North Broken Hill own Zeehan Mines Pty. Ltd. in equal share; the company is developing an exploratory mine on the Zeehan field, Tasmania.

company. Sulphide Corporation Ltd. is a manufacturer of chemical fertiliser and Portland cement. Consolidated Zinc Pty. Ltd. is a holding company of the smaller manufacturing subsidiaries, and supply, service, and developmental subsidiaries. Imperial Smelting Corporation Ltd. is a holding company; its chief subsidiary, National Smelting Co. Ltd., is the smelting company, and also a holding company of various manufacturing and non-manufacturing subsidiaries.

Relationship of Refining Companies to Mining Companies: Consolidated Zinc Corporation (through Broken Hill Corporation and Zinc Corporation), North Broken Hill and Broken Hill South own The Broken Hill Associated Smelters Pty. Ltd., which operates the lead smelter/refinery at Port Pirie. C.Z.C. holds 50 per cent. of the shareholdings, North Broken Hill about 36 per cent. and Broken Hill South about 14 per cent. — Broken Hill South and North Broken Hill each have a fairly large holding in Electrolytic Zinc Co. of Australasia Ltd., which operates the zinc refinery at Risdon, but public holdings are collectively in the majority of the ordinary capital of Electrolytic Zinc. — Broken Hill South and North Broken Hill own The Electrolytic Refining and Smelting Co. of Australia Pty. Ltd., which operates the copper smelter/refinery at Port Kembla. B.H. South has a majority interest with 60 per cent., and North B.H. has 35 per cent. (having recently taken over the 34 per cent. holding of The B.H.A.S. Pty. Ltd., now not a shareholder in E.R. & S.). — Consolidated Zinc Corporation is the parent company of Imperial Smelting Corporation Ltd., U.K., which in turn is the company holding National Smelting Co. Ltd., U.K. National Smelting processes zinc concentrate from the Zinc Corporation and New Broken Hill Consolidated mines at Broken Hill (about 50 per cent. of the supply to National Smelting) and from elsewhere than Australia. (All the lead concentrate from mining at Broken Hill is refined in Australia. The zinc concentrate of the Broken Hill South and North Broken Hill mines is treated in Australia, and the remainder of Broken Hill concentrate, from the Z.C. and N.B.H.C. mines, is shipped to the U.K., its sulphur content being a substantial part of sulphuric-acid production in the U.K.)

Directorial Relationships: There is no overlapping of directorates between Broken Hill South, North Broken Hill, Consolidated Zinc Corporation and New Broken Hill Consolidated, other than between C.Z.C. and N.B.H.C. and two North B.H. directors on the Australian board of N.B.H.C. — Various directors of Broken Hill South, North Broken Hill and Zinc Corporation make up the entire directorate of Broken Hill Associated Smelters. — The London directors of Electrolytic Zinc are mostly directors of Consolidated Zinc Corporation, and half the Australian board of E.Z. are directors of either Broken Hill South, North Broken Hill or New Broken Hill Consolidated. — Various directors of Broken Hill South and North Broken Hill make up the entire directorate of Electrolytic Refining & Smelting.

Investments Outside Mining and Refining: In the past, Broken Hill South, North Broken Hill, certain of the component companies of Consolidated Zinc Corporation (which consolidated in 1949), and Electrolytic Zinc, have tended to invest in the same companies, both within and outside their own fields. Within the industry there has been investment in the usual activities of metal smelting and refining and power production directly connected with the mining of ores. Investment in "outside" fields has frequently involved extension in logical directions such as metal fabrication and paint manufacture—industries whose prosperity is closely bound up with Broken Hill mining production. In the establishment or encouragement of these, as well as others like aircraft and paper production, investment by the Broken Hill mining companies has had far-reaching effect on Australian industrial development in the past thirty years. — B.H. South and North B.H. have been the most active in "outside" investment and are increasing their holdings. C.Z.C., however, in recent years has disposed of practically all its incidental investment in order to help finance the development of its own structure of companies; it continues to hold half the total shareholdings of The Broken Hill Associated Smelters (Zinc Corporation and New Broken Hill Consolidated are collectively the largest producers of lead concentrates at Broken Hill), and retains a not unsubstantial holding in Metal Manufactures Ltd. The principal "outside" companies in which the non-ferrous mining companies have investments are as follows—

Metal Manufactures Ltd. and its wholly-owned subsidiary company Austral Bronze Pty. Ltd. make most of the copper, brass and bronze finished shapes made in Australia. Broken Hill South, North Broken Hill, Electrolytic Zinc, and Consolidated Zinc Corporation (through Broken Hill Corporation), are each substantial shareholders, collectively to the extent of about 45 per cent. of ordinary capital of the company. (Broken Hill Associated Smelters and Electrolytic Refining & Smelting were shareholders, but their holdings passed to the parent mining companies.) Other significant shareholders in Metal Manufactures Ltd. are Mt. Lyell Mining and Railway Co. Ltd. (the only substantial investment association of that company with the other companies named), Imperial Chemical Industries of Australia and New Zealand Ltd., British Insulated Cables manufacturing companies, and British Aluminium Co. Ltd. Metal Manufactures Ltd. has three direct associate companies, all making cables in Australia: Austral Standard Cables Pty. Ltd. (with Callender's Cables Ltd.); and Cable Makers Australia Pty. Ltd. (with the Cable Makers Association of England). (See Chapter 11, "Electrical and Electronic Products", for details of wires and cables manufacture in Australia.)

Australian Aluminium Co. Pty. Ltd., the largest manufacturer of aluminium finished shapes in Australia. Electrolytic Zinc (20 per cent.) and Metal Manufactures (13 per cent.) hold one-third of the ordinary shareholdings of Australian Aluminium, and Aluminium Ltd. (of Canada) and British Aluminium Co. Ltd. each hold one-third.

Other companies in which at least two of three mining companies—B.H. South, North B.H., E.Z.—have retained substantial investments in ordinary shares are—

Associated Pulp & Paper Mills Ltd., largest manufacturer in Australia of writings and printings (other than newsprint), and, through subsidiary companies, manufacturer of true vegetable parchment wrapping paper, coated paper and board, and hardboard wallboards.

British Australian Lead Manufacturers Pty. Ltd., a large manufacturer of lead paints, synthetic finishes, etc.

Commonwealth Aircraft Corporation Pty. Ltd., one of the principal manufacturers of military aircraft in Australia, and the only manufacturer of aircraft engines. (The Broken Hill Proprietary Co. Ltd. has a substantial investment in C.A.C. Pty. Ltd.)

Commonwealth Steel Co. Ltd. (a subsidiary company of The Broken Hill Proprietary Co. Ltd.), only manufacturer in Australia of stainless steel and finished shapes, principal manufacturer of other alloy steels, and of axles, wheels and tyres for railways and tramways rolling stock.

Courtaulds (Australia) Ltd. (associated with Courtaulds Ltd.), at present establishing in Australia a factory for making viscose and acetate rayon yarns which are not made in Australia.

Imperial Chemical Industries of Australia and New Zealand Ltd., largest manufacturer of chemicals, explosives, ammunition, leathercloth and slide fasteners in Australia, and itself having substantial investment in other industries. (The Broken Hill Proprietary Co. Ltd. has a substantial investment in I.C.I.A.N.Z. Ltd.)

Unassociated Companies

Mt. Lyell Mining and Railway Co. Ltd.: Operates several mines (copper-gold-silver) in the Mt. Lyell area, a hydro-electric station for portion of its power requirements, a smelter and electrolytic refinery for copper, and a common-carrier railway from Queenstown to Strahan (22 miles). It has no investment in other major non-ferrous mining companies, and its directors are not on the directorates of other Australian non-ferrous mining, smelting or refining companies. The company, however, with a tin-mining company (Aberfoyle Tin N.L.) and Mount Morgan Ltd., operates Australian Drillers Pty. Ltd., a minerals-search company. Mt. Lyell has major investments in the chemical-fertiliser industry in Australia, and in Metal Manufactures Ltd., and has a relatively small investment in Imperial Chemical Industries of Australia and New Zealand and an engineering and electrical appliance manufacturing company.

Mount Morgan Ltd.: Operates one mine (gold-copper) and a blister copper smelter, at Mt. Morgan. It has no investments in other non-ferrous mining companies in Australia, and its directors are not on the directorates of other Australian non-ferrous mining companies. The company is a partner, however, with a tin-mining company (Aberfoyle N.L.) and Mt. Lyell Mining and Railway Co. Ltd. in Australian Drillers Pty. Ltd., a minerals-search company. The only other investment of Mount Morgan Ltd. in Australia is in Commonwealth Inscribed Stock.

Mount Isa Mines Ltd.: Operates one mine (lead-zinc, and copper) and a lead smelter, at Mt. Isa (and is now erecting a copper mill and smelter for production of fire-refined copper). Mount Isa Mines Ltd. has no investments in other major non-ferrous mining companies in Australia, and its directors are not on the directorates of other Australian non-ferrous mining companies. The company apparently has no major investments in Australian industry.

Lake George Mines Pty. Ltd.: Operates one mine (lead-zinc-copper) at Captain's Flat, N.S.W. The company has no investments in other major mining or manufacturing companies, and its directors are not on the directorates of major non-ferrous mining companies in Australia.

Montana Silver Lead No Liability: Operates one mine (lead-zinc-silver), at Zeehan, Tas. The company has no investments in other mining or manufacturing companies, and its directors are not on the directorates of major non-ferrous mining companies in Australia.

New Occidental Gold Mines No Liability: Operates two mines (copper with gold content) at Cobar, N.S.W. The company has no investments in other mining or manufacturing companies, and its directors are not on the directorates of major non-ferrous mining companies in Australia.

THE FERROUS METALS INDUSTRY

The Australian iron and steel industry is an industry that can be described as mature; it has only to produce tinplate, and construction of capacity to that end has begun.

A small group of large companies, of which The Broken Hill Proprietary Co. Ltd. is

the central and unifying company (as the source of steel feed), constitutes, with Lysaght's Works Pty. Ltd. of the Guest, Keen & Nettlefolds group, all but a small portion of the industry (excluding iron and steel foundries, and forges).

The B.H.P. Group, including Tubemakers of Australia Ltd.

The B.H.P. Co. Ltd. from its entry (see previous section, "The Non-ferrous Metals Industry") into the industry in 1913 (production began in 1915) aimed to develop in the fully vertical manner—from coal and ore to finishing and fabricating of steel products. It encouraged establishment and expansion of processing activities by companies relying on steel feed from the B.H.P. works at Newcastle. As the industry developed The B.H.P. Co. Ltd. and all of the principal finishing companies

except one, Lysaght's Works Pty. Ltd., became one group of financially subsidiary or associated companies.

Until 1935, Australian Iron & Steel Ltd. was a competitor of The B.H.P. Co. Ltd., but did not manufacture beyond rolled finished shapes, spun cast-iron pipes, fabricated steel pipe, and structural-steel work. A.I. & S. Ltd. has an interesting lineage. The Eskbank Iron Works was established at Lithgow, N.S.W., in 1875, for smelting of local ore into pig iron, puddling

of iron into wrought-iron bar, and working of scrap into miscellaneous products. In 1894 a sheet-rolling mill and galvanising plant were added, and by 1900 the works had begun manufacture of open-hearth steel, the first so made in Australia. In 1908 the Esbank Iron Works, then operated by William Sandford Ltd., was taken over by Hoskins Bros. and called the Lithgow Iron and Steel Works. The works were rapidly expanded. The first rails made in Australia were rolled at this works, which made a wide range of plain carbon steel and also supplied many tons of high-grade steel for rifle manufacture during the 1914-18 War (the Commonwealth Small Arms Factory had been established at Lithgow in 1913). In 1920, a company named Hoskins Iron & Steel Co. Ltd. took over the works, which continued to expand. In 1927 the company began construction of an iron and steel works at Port Kembla, N.S.W., as it had decided to leave Lithgow, which had become unsuitable; the first iron was made at Port Kembla in 1928, and by the end of 1931 all activities had been transferred. In 1928, Australian Iron & Steel Ltd. was formed, with widened shareholdings—the ordinary shares were held by the Hoskins shareholders (about 48 per cent.), Dorman Long & Co. Ltd., U.K. (about 28 per cent.), Baldwins Ltd., U.K. (about 5 per cent.), and Howard Smith Ltd., an Australian shipping company (about 19 per cent.), and the preference shares were held by the Hoskins preference shareholders (32½ per cent.) and the public otherwise (67½ per cent.). The company secured its iron ore from the Iron Monarch leases of The B.H.P. Co. Ltd., that company having agreed to supply under a ten-year contract from 1925 (A.I. & S. Ltd. held the leases, obtained in 1927, of the large but unworked deposit at Cockatoo Island, Yampi Sound, W.A.) The great economic depression of the early 1930s affected A.I. & S. Ltd. to the extent that its independent existence came to an end. At 1935, The B.H.P. Co. Ltd., which had safely weathered the depression, bought all the ordinary shares of A.I. & S. Ltd. with an issue of its own shares, and left the large preference shareholding with the Hoskins shareholders and the public.

The B.H.P. Co. Ltd. has no investments in the iron and steel industry outside Australia. The B.H.P. group comprises twenty-six incorporated companies (excluding non-manufacturing companies that are not subsidiary companies of The B.H.P. Co. Ltd.)—the parent and central company, The Broken Hill Proprietary Company Ltd.; ten subsidiary companies of the parent company, four of which are wholly owned; one company in which the majority shareholding is represented by the combined holdings of two of the subsidiary companies of The B.H.P. Co. Ltd.; one company in which a subsidiary company will have a holding of half the issued shares; five companies in which The B.H.P. Co. Ltd. has shareholdings up to half of the issued capital. One of the five associated companies, solely a holding company, has seven manufacturing companies in its structure—five wholly-owned subsidiary companies, one of which has a wholly-owned subsidiary company; and a 60 per cent. owned company. Another of the associated companies has an associate company engaged in the same activity as itself.

As at 31/5/52, issued capital of The Broken Hill Proprietary Co. Ltd. was £24.94 million, by far the largest of any company in Aus-

tralia. The balance-sheet value of shares in subsidiary companies was then £15.47 million, and in other companies £2.30 million. Latest available information shows issued capital of the four wholly-owned subsidiary companies (Rylands Bros., B.H.P. By-Products, Titan Manufacturing, Bullivant's) aggregating about £1 million, and that of the other six direct subsidiary companies £17.72 million; of this latter amount The B.H.P.'s shareholdings aggregating £16.04 million was spread as follows: Australian Iron & Steel £13.5 million, Commonwealth Steel £1.64 million, Lysaght Bros. £0.45 million, B.H.P. Collieries £0.33 million, Australian Wire Rope £0.11 million, and Port Waratah Stevedoring, £1.163. Shares in the five direct associate companies were valued at about £1.69 million, of which £1.26 million was in Tubemakers of Australia Ltd.; the issued capital of the direct associate companies was about £4.0 million.

The B.H.P. Co. Ltd. has substantial investment shareholdings in two other companies (neither of which are users of steel "feed" or large tonnages of steel in manufacture of their products)—Imperial Chemical Industries of Australia and New Zealand Ltd. (see Chapter 6) and Commonwealth Aircraft Corporation Pty. Ltd. (see Chapter 10).

The group operates about sixty establishments in mining, quarrying, manufacturing and servicing (considering certain multiple establishments as one establishment, such as iron-ore quarries, ore-transport railway line and ore-loading jetty, Middleback Range and Whyalla, in one instance, the integrated iron works, steel works and steel mills and domestic services at Newcastle and Port Kembla in two other instances). The sixty establishments are distributed over the six States of the Commonwealth.

The B.H.P. group's capacity in Australia comprises, in the main—

Two main iron-ore quarries (one at Iron Monarch, S.A., one at Cockatoo Island, Yampi Sound, W.A.), at leases covering the major part of Australia's known high-grade iron-ore deposits. Ore-transport railway-line (Iron Monarch to Whyalla) and ore-loading jetties. (The B.H.P. Co. Ltd. is negotiating (May, 1952) with the State Government of Western Australia for the lease of the Koolan Island deposits, Yampi Sound.)

Quarries for limestone, dolomite, bauxite, magnesite.

Eleven collieries, nine of which are coking-coal collieries close to the two integrated iron works, steel works and steel mills; and two coal-railways. A subsidiary company making Portland cement also owns and operates a colliery for its own needs.

Seven of the eight blast-furnaces in Australia. (The other is a small cold-blast charcoal-iron furnace for pig. at Wundowie, W.A., part of a wood-distillation works owned and operated by the State Government of Western Australia.)

All the by-product coke-ovens in Australia, and all the capacity for manufacture of chemicals from by-products of the coke-ovens. Roadmaking capacity as contract service, using blast-furnace crushed and graded slag and by-product tar (and bitumen).

Most of the capacity in Australia for manufacture of special steels and alloy steels in electric furnaces.

Nearly all the capacity in Australia for ferro-alloy manufacture.

All the capacity in Australia for manufacture of tungstic acid and tungsten powder.

All the open-hearth steelmaking capacity in Australia and also all the capacity for production of intermediate rolled products from open-hearth ingots.

Nearly all the mill capacity in Australia for production of finished shapes of steel other than of steel sheet.

Nearly all the mill capacity in Australia for drawing of steel wire. All the capacity for manufacture of wire rope. Capacity for manufacture of mass-consumption wire products (but not screws, nuts and bolts, chain).

All the capacity in Australia for manufacture of files, rasps, auger bits. Most of the capacity for manufacture of wood chisels and gouges, and table knives.

Most of the capacity in Australia for manufacture of tyres for railways and tramways rolling stock, including steam locomotives.

All the capacity in Australia for manufacture of continuous-weld (Fretz-Moon) pipe, seamless hot-drawn pipe, seamless cold-drawn tube and welded precision tubing, and most of the Australian capacity for manufacture of wrought-steel and malleable-iron pipe fittings. Capacity for manufacture of close-joint electrical conduit and welded screwed electrical conduit. All the capacity in Australia for manufacture of spun cast-iron pipe. Capacity for manufacture of fabricated steel pipe and other structural steel work.

Most of the capacity in Australia for manufacture of steel drums, underground petrol tanks. Capacity for manufacture of beer-transport drums, hot-water services.

Capacity for manufacture of Portland cement.

Capacity for manufacture of zinc oxide.

The largest non-Government shipping line in Australia; and stevedoring capacity.

The largest shipbuilding yard in Australia. Capacity for ship-engine building, including manufacture of turbines and reduction gears.

Sea transport is an integral, indispensable part of the group's ability to operate economically. The B.H.P. ships carry iron-ore, limestone and dolomite more than one thousand miles from South Australia to the two integrated iron works, steel works and steel mills in New South Wales, and pig-iron from Whyalla to various ports en route. The ships are backloaded with steel products for ports en route (particularly Melbourne and Adelaide); steel plate, etc., for the Whyalla shipyard; coke and (from Rapid Bay) limestone for the Whyalla blast-furnace (which is principally engaged in making large tonnages of merchant pig-iron for the foundry industry of Australia); and occasionally coke for the silver-lead

smelter/refinery of Broken Hill Associated Smelters Pty. Ltd. at Port Pirie. Transport of iron-ore from Yampi Sound (north-west of Western Australia) has begun; it requires a haul of about ten days in 12,500-ton ships carrying 11,500 tons of ore, and a long portion of the back journey will usually be in water ballast. The B.H.P. shipping line at present (mid 1952) comprises fifteen ships, totalling about 132,000 tons deadweight. Eleven of the ships are owned by The B.H.P. Co. Ltd.—three of 12,500 d.w.ton, four of about 8,000 d.w.ton, and four of about 6,170 d.w.ton—totalling about 94,300 tons deadweight. Four ships are on time charter to the company—two about 10,500 d.w.tons, one of 10,000 d.w.tons and one of 6,785 d.w.tons. The line is used solely for the requirements of the B.H.P. group, but does not suffice and frequent voyage charters of additional ships are required. Another company-owned 12,500-ton ore-carrier has been launched and is now being fitted, and two of four 10,000-ton ore-carriers to be built are now being built. Two of the 8,000-ton ships and all of the 12,500-ton ships were built by The B.H.P. Co. Ltd., as will also be the four 10,000-ton ships. (See Chapter 10, "Transport Equipment", for details concerning the company's shipbuilding and ship-engine building activities.) The four 6,170-ton ships of the company's present fleet, all old ships, will be sold as the new ships come into use. (In addition, the Commonwealth Government has approved the building of ten 10,000-ton bulk-carriers, eight to be built in Australia, but not yet laid down, and two now being built in the United Kingdom. These ships, if owned by the Commonwealth Government shipping instrumentality—at present the Australian Shipping Board—will probably be available for either time or voyage charter work.)

The company structure and general activities of the B.H.P. group as at mid-1952 are as follows (and see also the descriptions of structure of relevant industries, elsewhere this Part and throughout the study)—

PARENT AND CENTRAL COMPANY

The Broken Hill Proprietary Co. Ltd., which directly carries on production of iron, steel and steel shapes, including special carbon steels (at one integrated works, Newcastle, N.S.W.); ferro-alloy manufacture, and manufacture of tungstic acid, tungsten powder, and tungsten-carbide tips, nibs, etc.; ship-building; ship-engine building; freighter shipping-line operation (for use of B.H.P. group only); coal-mining (four collieries); quarrying for iron-ore and other materials for most of the group's requirements; operation of ore railway and ore-loading jetty.

SUBSIDIARY COMPANIES

B.H.P. Collieries Pty. Ltd. owns and operates Elrington Colliery (adjacent to the Hebburn collieries) at Weston, near Cessnock, N.S.W., and a three-mile coal railway. The coal is for gas and steam. The company was established in 1923 by The B.H.P. Co. Ltd. in association with Hebburn Ltd., a subsidiary company of Huddart, Parker Ltd., an Australian shipping and coalmining company (the mine, however, was not in production until 1930). The B.H.P. Co. Ltd. holds two-thirds and Hebburn Ltd. one-third of the issued shares.

(Collieries of The B.H.P. Co. Ltd. and A.I. & S. Ltd.): The B.H.P. Co. Ltd. itself owns and operates four collieries and has the controlling interest in another colliery. A.I. & S. Ltd. owns and operates six collieries. Nine of the eleven collieries provide coking coal. In 1922 The B.H.P. Co. Ltd., after deciding to secure its coal requirements from its own resources and free itself from troublesome vagaries of trade supply, made an exhaustive geological survey of the Newcastle and Maitland coalfields. B.H.P. Collieries Pty. Ltd. (see above) was formed in 1923 to establish Elrington Colliery, for gas and steam coal, but various hindrances prevented that mine producing coal until 1930. In 1925 the establishment of a coking-coal colliery began, situated a few miles from the B.H.P. Newcastle works; this colliery, "John Darling", began production in 1927, and is wholly owned and operated by The B.H.P. Co. Ltd., as are also Burwood Colliery and Lambton Colliery, both coking-coal mines a few miles from Newcastle and both bought as going concerns in 1932. In 1949 the company bought Stockton Borehole Colliery, near Newcastle, as a going concern, for further coking-coal supplies, and operates the colliery itself. Hoskins Iron & Steel Co. Ltd., the predecessor of Australian Iron & Steel Co. Ltd., owned and operated coal mines, and at formation of Australian Iron & Steel Ltd. in 1928 its Wongawilli Colliery (coking coal) near Port Kembla and Steel Works Colliery (steam coal) at Lithgow became owned and operated by A.I. & S. Ltd., and have remained so. Four additional coking-coal mines near Port Kembla were secured following A.I. & S. Ltd. becoming in 1935 a subsidiary company of The B.H.P. Co. Ltd. In 1936 Bulli Colliery was bought as a going concern; in 1937 Mt. Keira Colliery was bought—it was established in 1857 and is the oldest working colliery in Australia; in 1945 Mt. Kembla Colliery was bought as a going concern, including a six-mile coal-railway from the mine to Port Kembla (in addition to Mt. Kembla coal, this railway now takes coal from Mt. Keira and Nebo Collieries to the A.I. & S. iron works, steel works and steel mills

at Port Kembla); and in late 1946 the establishment of Nebo Colliery began, initial production of coal beginning soon afterwards with the cutting of a temporary main-haulage tunnel "in the coal". (Nebo Colliery is notable, among other reasons, for a conveyor-belt system taking coal from the crusher near the mine portal to the A.I. & S. coal-railway, the conveyor being 2,220 feet long and dropping 209 feet from the crusher to the loading bin at the railway.)

Mechanisation of B.H.P. group collieries began in 1934, with introduction of coal-cutters into Burwood Colliery. By 1935 Lambton Colliery had been made the first completely mechanised mine in Australia. The first diesel locomotive used in an Australian colliery went into use at Mt. Keira in 1942. Nebo Colliery was designed and established as fully mechanised. The B.H.P. and A.I. & S. collieries are now amongst the best-equipped of mechanised mines in Australia—and nearly the whole of equipment installed in recent years was made in Australia, much of it at the engineering shops of the two companies.

B.H.P. By-Products Pty. Ltd. owns and operates plant at Newcastle, Sydney and Lismore, N.S.W., for distribution of naphthalene, creosote oil, wood-preserving oil, blowfly oil, road tar, tar pitch, graded slag and tarmac, bitumen and bituminous emulsion, and for the undertaking of contracts for building, re-surfacing and spraying of roads and similar paving. All the products derived from coal are secured from operations at the B.H.P. Newcastle iron and steel works. The company (absorbing De Meric Ltd., tar distillers) was established by The B.H.P. Co. Ltd. in 1923, and has remained wholly owned by The B.H.P. Co. Ltd. B.H.P. By-Products Pty. Ltd. has a small shareholding in Southern Portland Cement Co. Ltd.—see later concerning that company.

Australian Iron & Steel Ltd., as the owning and operating company, carries on production of iron, steel and steel shapes, including special carbon steels (at one integrated works, Port Kembla, N.S.W.); coalmining (six collieries and a coal railway); quarrying for iron-ore (Cockatoo Island quarry, Yampi Sound, W.A.) and limestone (quarry at Marulan, N.S.W., from which Southern Portland Cement Co. Ltd. is also supplied); spun-cast pipe production (at the iron and steel works); and fabrication of structural steel (one establishment at Melbourne, one at Sydney). A.I. & S. Ltd., in conjunction with B.H.P. By-Products Pty. Ltd., holds a slight majority of the shareholdings of Southern Portland Cement Co. Ltd. (see later). All the ordinary shares of A.I. & S. Ltd. are owned by The B.H.P. Co. Ltd. The preference shareholding is held by the public—individuals, estates, companies, etc. (See introduction to this comment on the B.H.P. group for information on the origin of A.I. & S. Ltd. and its purchase by The B.H.P. Co. Ltd.)

Southern Portland Cement Co. Ltd. owns and operates a Portland-cement works and a colliery (for its own coal supply) at Berrima, about 40 miles inland from Port Kembla, N.S.W. (The company has always secured its limestone from the Marulan quarry owned and operated first by Hoskins Iron & Steel Ltd. and then by Australian Iron and Steel Ltd.) The company was established in 1927 as a public company in which Howard Smith Ltd., ship owners and colliery owners, and Hoskins Iron & Steel Co. Ltd. had significant shareholdings. The Hoskins Iron & Steel Ltd. holding in Southern Portland Cement was transferred to Australian Iron & Steel Ltd. at formation of that company. A.I. & S. Ltd. has extended its holding to between 49 and 50 per cent. of the voting shares, and an associate company, B.H.P. By-Products Pty. Ltd., has acquired a small holding which gives the B.H.P. group a few shares over 50 per cent. Howard Smith Ltd. has about 41 per cent., and the remaining 9 per cent. is distributed widely, the company being still a public company. (An independent company, Southern Limestone Products Pty. Ltd., in adjacent plant to the cement works, purchases for lime making a portion of the limestone brought from Marulan to the cement works; the majority of shares in the company are held by members of the Hoskins family.)

Commonwealth Steel Co. Ltd. owns and operates an establishment at Newcastle, N.S.W., for the making of steel (electric furnace and open-hearth) and the rolling, casting and forging of steels, including the manufacture of axles, tyres and wheels (the principal of the two manufacturers of wagon tyres in Australia) for railways and tramways rolling stock, including locomotive driving-wheel tyres. The company is the principal manufacturer in Australia of alloy steels, supplied in merchant-bar finished shapes and, in stainless steel, also in sheet; at times, special carbon steels of unusual specification are also made in merchant-bar shapes (manufacture of special carbon steels in Australia is mainly carried on by The B.H.P. Co. Ltd. and A.I. & S. Ltd.). Castings and forgings in special steels and alloy steels are also supplied. Carbon steels are made by the company in quantity for wheels, tyres and axles and for general casting and forging at the establishment, the company being equipped, in particular, to make very large castings and forgings for industry generally. The company also occasionally uses billets, etc., of carbon steels and special steels obtained from The B.H.P. and A.I. & S.

The 1914-18 War had exposed the great need for wheels, tyres and axles (practically all imported) to be made in Australia for the already well-established activity of rolling-stock manufacture. By 1917 Thompsons Castlemaine Pty. Ltd., at Castlemaine, Vic., general and railway engineers of long standing and wide range of experience, was preparing to enter into manufacture of tyres (see also below). In April, 1917, the representatives of four engineering companies of Newcastle and Sydney met to discuss the creation of a company to make wheels, tyres and axles. The companies (all of which are still active and major companies) and their activities at 1917 were A. Goninan & Co. Ltd., general engineers at Newcastle (among other products, manufacturers of main-line coal wagons), The Clyde Engineering Co. Ltd., at Sydney, and tramcars), Ritchie Bros., at Sydney (specialising in manufacture of railway carriages and vans), and The Pioneer Spring Co. Ltd., at Sydney (manufacturers of springs for locomotives, rolling stock and tram-cars, and other types of springs). It was decided to form a company for wheel, tyre and axle manufacture, to be known as Commonwealth Steel Products Company Ltd., and to seek technical advice abroad. In early 1918 Howard Smith Ltd., ship and colliery owners and investors in Australian industry, joined the company, which was incorporated in March, 1918 (with each of the five promoting, investing companies represented by one director on the board of the new company). During formation of the company and establishment of plant, the promoters arranged for Taylor Bros. & Co. Ltd., U.K., major manufacturers of rolling-stock wheels, tyres and axles in the United Kingdom, and considerable suppliers of such to Australia, to become a not inconsiderable shareholder, which it did in November, 1919, appointing its Australian agent as its director on the new company's board. (The group of rolling-stock manufacturers of which the U.K. company was a part, soon afterwards became part of the Vickers structure in the U.K.)

Production by Commonwealth Steel Products Ltd. began in 1919, with one electric-arc steelmaking furnace, a small foundry, a rolling-stock wheel, tyre and axle plant, forge shop and machine shop. (While the company was developing to the production point, Thompsons Castlemaine Pty. Ltd., which had begun production of tyres in 1918, using B.H.P. open-hearth steel, was supplying much of Australia's tyre needs. Thompsons—later Thompsons Engineering & Pipe Co. Ltd., and now Thompsons Castlemaine Ltd.—have remained tyre makers, of which it and Commonwealth Steel are the only makers in Australia. Thompsons now get their tyre steel (in cheescs) from Commonwealth Steel.)

In 1923 a major step was achieved when a 2,000-ton forging press was installed to put into effect the company's desire to cater for heavy forging, for which there was great need. In late 1923, two events occurred which were to firmly establish the company after its difficult early years. The first of these was that arrangements were made for Vickers Ltd., U.K., to invest in the company and to be allotted shares in exchange for technical assistance in furthering the desire of Commonwealth Steel to make special and

alloy steels; the name of the company was soon afterwards changed to Vickers-Commonwealth Steel Products Ltd. The second event was an arrangement for The B.H.P. Co. Ltd. to supply the company with open-hearth steel ingots for tyre cheeses, etc. By 1925 steps were being taken to considerably increase the foundry area. By 1927 the company was also making alloy-steel castings and forgings, manganese-steel, points and crossings for rail and tram tracks, and dredge and mining equipment. In May, 1929, The B.H.P. Co. Ltd. bought a shareholding in the company and in January, 1935, secured control of the company by cash purchase of the large shareholding of the Vickers group (held by The English Steel Corporation Ltd. and Taylor Bros. & Co. Ltd.). Technical assistance, licences, etc., from the Vickers group continued after Vickers Ltd. sold its financial interest to The B.H.P. Co. Ltd. Also in 1935 the shareholding of Howard Smith Ltd. in the company was bought by The B.H.P. Co. Ltd. (Howard Smith Ltd., which was one of the promoters of the company—see above—became a large shareholder in 1935 in The B.H.P. Co. Ltd. by payment in B.H.P. shares for the sale of its large shareholding in Australian Iron & Steel Ltd. to The B.H.P. Co. Ltd.) In 1935 the name of the company was changed to the present name, Commonwealth Steel Co. Ltd.

From 1933, when the company acquired a licence to make and began making nitralloy steels in Australia, its expansion has been marked and considerable. In 1935 the company, to cope with development of its alloy-steel business, installed the second of its present five electric furnaces for steelmaking, and installed a second heavy-forging press, of 1,200 tons, to handle the demand for general heavy forging. In 1936 an "Edgewater" tyre-rolling mill was in use (the only such mill in Australia, and one of the few in the British Commonwealth). By 1936 solid wheels and weldless forged rings of large diameter were being made. By 1940, manufacture began of rolled products—light merchant bar, and sheet, mainly in alloy steels—and in 1942 the company's open-hearth furnace came into use. The company's expansion is continuing in capacity and range of products, a notable addition now being added to plant being a 5,000-ton forging press. (However, the making and supply of special carbon steels in merchant-bar shapes is within the B.H.P. group mainly an activity of The B.H.P. Co. Ltd. and A.I. & S. Ltd., and of steel-sheet other than of stainless-steel entirely the activity of Lysaghts Works Pty. Ltd.)

The B.H.P. Co. Ltd. owned (at late 1951) about 82 per cent. of the company's shares; three major non-ferrous companies owned about 8 per cent.—Broken Hill South Ltd. 3 per cent., Electrolytic Zinc Co. of Australasia Ltd. 3 per cent., North Broken Hill Ltd. 2 per cent.; a coalmining company, J. & A. Brown & Abermain Collieries Ltd., owns about 3 per cent.; and the remaining 7 per cent. is held mainly by individuals and estates. Shareholders other than The B.H.P. Co. Ltd. are mostly original shareholders or of long standing; of the five firms which were the chief promoters of the original company, only one, Ritchie Bros., has remained a shareholder.

Rylands Brothers (Australia) Pty. Ltd. owns and operates a wire and wire-products mill at Newcastle, N.S.W., and makes steel wire and wire products, and steel fencing-posts. In 1921 Rylands Bros. Ltd., U.K., and the Austral Nail Company Pty. Ltd., Newcastle, N.S.W., formed Rylands Brothers (Australia) Ltd. for manufacture of wire and wire products, particularly wire netting. The Austral Nail Company had originated at South Melbourne, Vic., in 1889, making nails; in 1905 it began making barbed wire also; in 1911 it began drawing its nail wire, from imported rod; in 1918 the supply of rod from the newly-established B.H.P. rod-mill enabled it to cease importing wire-rod; and by late 1919 the company was producing wire and wire products at a new wire-mill erected on a site adjoining the B.H.P. works at Newcastle. In 1921 Rylands Brothers Ltd., U.K., decided to make netting and other wire products in Australia, as a branch activity, but finally, the same year, it effected a merger with Austral Nail Co. to form Rylands Brothers (Australia) Ltd., the Austral Nail Co. having a controlling interest. In 1925 the entire shareholding in Rylands Brothers (Australia) Ltd. was acquired by The B.H.P. Co. Ltd., and remains wholly owned by The B.H.P. A second Rylands (Australia) factory is now nearing completion—it is at Geelong, Vic.; production is expected to begin in early 1953, and the mill in its initial years will be primarily engaged in making manufacturers' wire.

Lysaght Brothers & Co. Pty. Ltd. owns and operates a wire and wire-products mill at Sydney, and makes steel wire, wire products and dry zinc oxide. The works was established in 1884 for manufacture of wire-netting as a branch of John Lysaght Ltd., U.K. By the early 1900's Australian capital had entered into the business, which was incorporated as a company in 1905 and participation by Lysaght's, U.K., ceased. Up until 1906 the company had made only wire-netting; a decision to widen the company's activities so as not to be dependent upon one product led to the company, by 1910, being well established in production of barbed wire and wire nails. It had also begun manufacture of zinc oxide, of which it was the pioneer manufacturer in Australia. In 1916 the company, which until then had to import its wire, began wire drawing, being encouraged in this development by factors arising from the war which had just begun, the announcement by The B.H.P. Co. Ltd. that it would install a wire-rod mill as part of the iron works, steel works and steel mills it began erecting in 1913, and the establishment then under way (at Risdon, Tas.) of an electrolytic-zinc refinery from which adequate quantities of zinc for galvanising could be secured. The company had to import its wire-rod requirements until September, 1918, when The B.H.P. Co. Ltd. was able to supply, having just completed the installation of its Morgan wire-rod mill—the first rod-mill in Australia. Establishment of the rod-mill (providing an Australian source of wire-mill feed) and the manufacture of wire by Austral Nail Company (later Rylands Bros.) from B.H.P. wire-rod at a wire-mill established adjoining the B.H.P. works, led to substantial changes in wire and wire-products manufacture in Australia in the decade 1921-30. In 1925 The B.H.P. Co. Ltd. entered into wire and wire-products manufacture by taking over Rylands Bros. (Aust.) Ltd., and extended its wire-products activities in 1927 by buying a half share in a Victorian wire-products manufacturing company (see The Titan Manufacturing Co. Pty. Ltd., following). In 1929 The B.H.P. Co. Ltd. bought a controlling interest in Lysaght Brothers & Co. Pty. Ltd., and now holds about 90 per cent. of the shares, the remainder being held by individual shareholders of long standing. (The company is not associated in shareholdings with Lysaghts Works Pty. Ltd., Newcastle and Port Kembla, nor with John Lysaght (Aust.) Pty. Ltd., both of which are subsidiary companies of John Lysaght Ltd., U.K.—see "The Guest, Keen & Nettlefolds Group", later.)

Lysaght Durham Chemical Co. Pty. Ltd. was incorporated in August, 1952, to take over the zinc-oxide factory of Durham Chemicals (Aust.) Pty. Ltd. at Melbourne, Vic.; the factory was established in 1951, but has not yet begun production. The new company will be owned in joint equal share by Lysaght Bros. & Co. Pty. Ltd. (see above) and Durham Chemicals (Aust.) Pty. Ltd.; the latter company is a subsidiary company of Durham Chemicals Ltd., U.K., and is a manufacturer of zinc oxide at its Sydney factory. Lysaght Bros. also makes zinc oxide.

The Titan Manufacturing Co. Pty. Ltd. (recently The Titan Nail & Wire Pty. Ltd.), owns and operates three factories and makes wire products (but not wire), wood chisels and auger bits. The company had its origin in 1888 in a business in Melbourne making barbed wire. Within a few years Titan Engineering Works came into existence from that business; by then nails, staples and other wire products and sheet-metal products were also being made. In 1900 a larger factory was built on a site in South Melbourne near where the present Melbourne factory is situated. In 1921 the business was incorporated, and became Titan Manufacturing Co. Ltd.; this company was the first manufacturer of shovels in Australia. In 1927 the wire-products section became The Titan Nail & Wire Pty. Ltd., one-half of the shares of the new company being taken up by The B.H.P. Co. Ltd. (see comment on Lysaght Brothers & Co. Pty. Ltd., preceding, for outline of change in the wire-products industry resulting from establishment of a wire-rod mill by The B.H.P. Co. Ltd.). Titan Manufacturing Co. Pty. Ltd. continued making sheetmetal products until 1931 when production of such ceased, and in 1933 that company sold its one-half holding in The

Titan Nail & Wire Pty. Ltd. to The B.H.P. Co. Ltd., giving the latter sole ownership of The Titan Nail company. In 1936 The Titan Nail moved into new factory premises at which it is at present operating. In 1944 The Titan Nail bought, as a going concern, Emu Nail Co., Hobart, Tas. (originally of Clifton Hill, Vic.), manufacturers of nails and barbed wire, and have continued the manufacture there of those products. In 1945, The Titan Nail began making wood chisels at a second and new Hobart factory, followed by wood gouges; and in 1949, auger bits. (The company is the only manufacturer in Australia of auger bits and the principal manufacturer of wood chisels and gouges; all these woodworking tools are specially made for use on Australian hardwoods.)

The Australian Wire Rope Works Pty. Ltd. owns and operates a factory at Newcastle, N.S.W., and makes only wire ropes. The company was established in late 1922 (production began in 1925) by four United Kingdom companies, after consultation with The B.H.P. Co. Ltd. concerning quality and delivery of wire-rod feed to Rylands Bros. (Aust.) Ltd., for drawing into wires suitable for wire-rope manufacture. The U.K. companies were Bullivant & Co. Ltd. (principal shareholder), T. & W. Smith Ltd., Allan Whyte & Co. Ltd. and Rylands Bros. Ltd. (The first three companies are wire-rope manufacturers. Each company, with several others making either wire ropes and/or cordage of fibres, became part of British Ropes Ltd., about 1925 and 1926.) Rylands Bros. (Aust.) Pty. Ltd., an associate company of Rylands Bros. Ltd., U.K., until 1925 (when The B.H.P. took over the Australian company in entirety), has made the wire for the wire-rope factory since production began in 1925. In 1935 The B.H.P. Co. Ltd. bought a controlling interest in The Australian Wire Rope Works Pty. Ltd., and now owns about 91 per cent. of the shares. About 6 per cent. of the remainder of the shares are held in Australia separately by three Australian companies—two cordage companies, James Miller & Co. Ltd. and A. Forsyth & Co. Pty. Ltd., and a ship owning and operating company, Melbourne Steamship Co. Ltd., all of which have been shareholders of the company since prior to 1935.

Bullivant's Australian Co. Pty. Ltd., Sydney, N.S.W., operates only in New South Wales where it is the sole distributor of steel wire ropes made by The Australian Wire Rope Works Pty. Ltd. (see above), and of the "Bullivant" brand wire ropes made by British Ropes Ltd., U.K. The company was established in Australia in 1935 by Bullivant's Australian Co. Ltd., U.K., (a subsidiary company of Bullivants & Co. Ltd., U.K., then and now a subsidiary company of British Ropes Ltd.; Bullivants & Co. Ltd. had participated, as principal shareholder, in establishment of The Australian Wire Rope Works Ltd. in 1923). In 1935 Bullivant's Australian Co. Pty. Ltd. (that is, the company registered in Australia) was bought in entirety by The B.H.P. Co. Ltd. from Bullivant's Australian Co. Ltd. (that is, the U.K. holding company), and has remained wholly owned by The B.H.P. Co. Ltd.

The Port Waratah Stevedoring Co. Pty. Ltd. owns and operates stevedoring plant, and carries on stevedoring at Newcastle and Melbourne. The company was established in 1923 for operation at Newcastle and in 1929 also began operating at Melbourne. Activities are limited to requirements of the B.H.P. group and of Lysaght's Works Pty. Ltd. (The B.H.P. Co. Ltd. carries out the stevedoring work required by it at Whyalla. At other ports, stevedoring services are hired for the group's requirements.) At establishment the company was owned 55 per cent. by The B.H.P. Co. Ltd., about 22 per cent. by Rylands Bros. (Aust.) Ltd. (subsequently a subsidiary company of The B.H.P. Co. Ltd.), and about 22 per cent. by Lysaght's Works Pty. Ltd. (a company of the Guest, Keen & Nettlefolds group). Ownership has remained as at establishment.

ASSOCIATE COMPANIES (all directly related to the iron and steel industry)

The Newcastle Chemical Co. Pty. Ltd. owns and operates a chemical-products factory adjacent to the B.H.P. Newcastle iron and steel works, and uses naphthalene and sulphate of ammonia from the coke-oven by-products and tar-distillation plants of those works to make phthalic anhydride, beta naphthol, ammonium chloride, sodium sulphate. Hydrochloric acid has been made from ammonia liquor from The B.H.P. works. The company was established in 1940 (production began in mid-1940) by The B.H.P. Co. Ltd. and Imperial Chemical Industries of Australia and New Zealand Ltd., with equal interest, which has been maintained. (The B.H.P. Co. Ltd. has a substantial investment in I.C.I.A.N.Z. Ltd.)

Tubemakers of Australia Ltd. is a holding company, established in 1946, in which The B.H.P. Co. Ltd., with about 42 per cent. of the issued shares, is associated with Stewarts & Lloyds Ltd., U.K., about 44 per cent., and Tube Investments Ltd., U.K., about 14 per cent. (Stewarts & Lloyds Ltd. is one of about 96 companies that were scheduled to be absorbed into the Iron & Steel Corporation of Great Britain under the Iron and Steel Act 1949, which provided for nationalisation of the iron and steel industry of the United Kingdom by bringing under public ownership the main producing undertakings in certain sections of the iron and steel industry. The company has retained its identity within the Corporation, but all shares are owned by the Corporation. Prior to this taking place, Stewarts & Lloyds Ltd. and Tube Investments Ltd. were associated with each other; each company had in its share structure a small number of special shares called "liaison shares", those of Stewarts & Lloyds being owned by Tube Investments, and those of Tube Investments being owned by Stewarts & Lloyds. In addition, certain directors are on the boards of both companies, this remaining so after inclusion of Stewarts & Lloyds Ltd. into the Iron & Steel Corporation. The manufacturing activities of the two companies are largely complementary.) Tubemakers of Australia Ltd. wholly owns five manufacturing subsidiary companies (and two subsidiary company. In addition, Tubemakers has a controlling interest in a manufacturing company recently formed, but not yet manufacturing. The seven manufacturing companies and their activities are as follows—

Stewarts and Lloyds (Aust.) Pty. Ltd. owns and operates two factory establishments. One is at Newcastle, N.S.W. (adjacent to the B.H.P. works), and makes continuous-welded steel pipe (Fretz-fittings and carries on pipe manipulation. Pipe skelp and billet bar is obtained from the B.H.P. works. The second establishment makes malleable-iron pipe fittings, and is located adjacent to the factory of Stewarts & Lloyds (South Australia) Ltd. Stewarts & Lloyds (Aust.) Pty. Ltd. also carries on extensive distribution of its own and allied products from warehouses situated in the capital cities and other large cities.

Stewarts and Lloyds (South Australia) Ltd. owns and operates a factory establishment near Adelaide, S.A., where it makes hot-drawn weldless steel pipe (Wellman-Seaver push-bench process), particularly seamless hollows as steel feed for British Tube Mills (see below), and carries on pipe manipulation. Push-bench billets are obtained from The B.H.P. group.

The two Stewarts and Lloyds' companies are the only manufacturers in Australia of hot-drawn weldless pipe, and the Newcastle factory is the only manufacturer in Australia of continuous-welded pipe.

British Tube Mills (Australia) Pty. Ltd. owns and operates a factory establishment near Adelaide, S.A. (adjacent to the works of Stewarts and Lloyds (S.A.) Ltd.), and makes cold-drawn seamless steel tube and electric-welded precision steel tube, and carries on manipulation and fabricating of tube into various components and products for industry and for its own brands of products; non-tubular products have also been made, mainly cycle components. The works secures its seamless-tube feed mainly from the adjacent works of Stewarts and Lloyds (S.A.) Ltd., and also from

the Newcastle works of Stewarts and Lloyds (Aust.) Pty. Ltd. The strip for electric-welded tube is obtained from the B.H.P. group. British Tube Mills is the only maker in Australia of cold-drawn seamless tube and electric-welded precision steel tube, and is the only fabricator of many shapes from tube.

Automatic Tube Co. Pty. Ltd. owns and operates one factory establishment at Melbourne, Vic., and one at Sydney, N.S.W. Both factories make close-joint conduit and electric-welded screwed conduit.

Mephan Ferguson Pty. Ltd. owns and operates two factory establishments, one each at Melbourne, Vic., and Adelaide, S.A., and its wholly-owned subsidiary company, **Mephan Ferguson (N.S.W.) Pty. Ltd.** owns and operates one factory establishment at Sydney, N.S.W. The factories make fabricated steel pipe for water mains, etc., and are general fabricators of plate steel.

The Australian Bundy Tubing Co. Pty. Ltd. is establishing a factory establishment near Adelaide, S.A., in the same area as the factories of Stewarts & Lloyds and British Tube Mills. The company is owned by Tubemakers of Australia Ltd., 60 per cent., and Bundy Tubing Co., U.S.A., 40 per cent. The company will make "Bundy" tubing, a proprietary product used for, in particular, fuel lines in automotive vehicles, and in refrigerant lines in refrigerators, etc. (All such tubing is at present imported into Australia.)

The creation of Tubemakers of Australia Ltd. was a rationalisation of developments since 1934, when Stewarts and Lloyds began making pipe in Australia. Stewarts and Lloyds Ltd., U.K., had been supplying water pipe, bore casing, etc., to Australia for many years. In 1929 Stewarts and Lloyds Ltd. and The B.H.P. Co. Ltd. made an agreement to establish the manufacture of steel pipes in Australia, the capital being provided jointly. When production was ready to begin, in 1934, the then existing Stewarts and Lloyds (Australia) Ltd., a subsidiary company of the U.K. company, went into liquidation, its assets transferred to Buttwell Pty. Ltd., which in turn became the partnership under the name Stewarts and Lloyds (Australia) Pty. Ltd. Up until 1938, only the continuous-weld process was in use, and in that year the push-bench process was added. In 1939, British Tube Mills (Aust.) Pty. Ltd. was established. The company was owned about 45 per cent. by Stewarts and Lloyds (Aust.) Pty. Ltd. and about 55 per cent. by Tube Investments Ltd. Steel feed (seamless hollows) for the tube mills was provided for the first years by Stewarts and Lloyds' Newcastle works. In 1944 Stewarts and Lloyds (South Australia) Ltd. was established, and in 1945 began production of hot-drawn pipe from billets supplied from the Newcastle steel works; much of the output was seamless hollows as feed for the adjacent works of British Tube Mills. In 1938 British Tube Mills bought in entirety Automatic Tube Co. Ltd., which was established in Victoria in 1918, and in 1947 Automatic Tube established itself in Sydney by purchase of the conduit-making activities of Frank G. Spurway Pty. Ltd. (see page 156). In 1946, Tubemakers of Australia Ltd. was established to co-ordinate and simplify the structure of joint interests in Australia of Stewarts and Lloyds, Tube Investments and The B.H.P. Co. Ltd. In 1950 Tubemakers bought in entirety Mephan Ferguson Pty. Ltd., which was first established in 1876. In 1952 The Australian Bundy Tubing Co. Pty. Ltd. was formed.

Rheem Australia Pty. Ltd. owns and operates five factories, two at Sydney, N.S.W., and one each at Melbourne, Vic., Brisbane, Qld., and Perth, W.A. Each factory makes steel containers from 4 to 44 gallons capacity, underground petrol-storage tanks from 5 to 10,000 gallons capacity, and farm storage tanks. In addition, the Brisbane factory also makes stainless-steel beer containers and the second Sydney factory makes hot water storage systems. Production began at Sydney in 1937, at Melbourne in 1941, and at Perth in 1947. The steel-sheet requirements (other than of stainless steel) are practically all obtained from Lysaghts Pty. Ltd., and stainless steel sheet from Commonwealth Steel Co. Ltd. In addition to its own factories, Rheem Australia Pty. Ltd. established in 1950, in conjunction with A. Simpson & Son Ltd., Adelaide, S.A. (iron and brass founders, manufacturers of stoves and ranges, washing machines, hardware, kitchenware, sheetmetal products, wire products, porcelain-enamelled linings, and other metal products) a company named Rheem Simpson Ltd. This equal-partnership company took over the small and light drum department of Simpson's and (at June, 1952) at the instigation of Rheem is about to begin production of 44-gallon steel petrol containers. Rheem Australia Pty. Ltd. was established in 1936 by the Rheem Manufacturing Company, U.S.A., and in 1939 The B.H.P. Co. Ltd. bought a half interest, which has been maintained.

Wiltshire File Co. Pty. Ltd. owns and operates one factory, at Melbourne, Vic., and makes metal-working files, wood and leather rasps and table knives. The company was formed in early 1938 by McPherson's Ltd. and Mr. F. M. Wiltshire. In mid-1939 The B.H.P. Co. Ltd. joined the company and in early 1940 Nicholson File Company, U.S.A., also became a partner company. (The Nicholson Company is one of the largest manufacturers of files in the U.S.A. McPherson's Ltd. is a leading merchant of engineering supplies and is directly concerned in manufacture of black bolts and nuts, pumps of various types, machine tools and equipment and tools for machine tools, being the principal maker in Australia of black bolts and nuts and of machine tools; in addition to its holding in Wiltshire File Co. Pty. Ltd. the company has large interests in associated companies making bonded-abrasive products, sintered tool-tips, and precision bushed roller-chain.) Production of files and rasps began in 1940, and table knives (in quantity) in 1950; feed for files is obtained from Commonwealth Steel Co. Ltd. (which obtains the billet steel for file sections from the B.H.P. Newcastle works) and from Rylands Bros. wire mill, and feed for knives is obtained from Commonwealth Steel Co. Ltd. Nicholson File Company has a 38.8 per cent. holding in the company, The B.H.P. Co. Ltd. and McPherson's Ltd. each have a 28.6 per cent. holding, and Mr. F. M. Wiltshire a 4 per cent. holding.

The Structural Engineering Co. of W.A. Pty. Ltd. owns and operates an establishment at Perth, W.A., engaged in fabrication and erection of structural steel and construction of plant such as cranes, small steel vessels, etc. The company had its origin in 1918 when Elder, Smith & Co. Ltd., general merchants, wool brokers, pastoral and shipping agents throughout most of Australia, began fabricating of structural steel for a city building. Expansion of activities by Elder, Smith's Steel Division in steel and reinforced-concrete construction continued steadily. In 1928 Elder, Smith's and The B.H.P. Co. Ltd. established the present company to take over and further extend the activities of the Steel Division. The company is owned in equal shares by Elder, Smith & Co. Ltd. and The B.H.P. Co. Ltd. (The B.H.P. Co. Ltd. in early 1952 decided to establish a light merchant-bar steel mill at Perth, the billet feed for which will be provided by the Newcastle and Port Kembla works. See also Part Two of this Chapter.)

The Guest, Keen & Nettlefolds Group

Sheet steel, other than of stainless steel, is made in Australia only at three mills, wholly owned, through Lysaght's Works Pty. Ltd., by John Lysaght Ltd., U.K., itself a subsidiary company of Guest, Keen & Nettlefolds Ltd., U.K. All sheet-bar feed for the Australian works is obtained from the B.H.P. group, with

which an agreement exists, but there is no shareholding by the B.H.P. group in Lysaght's Works Pty. Ltd.

Lysaght's Newcastle mill began production in 1921.

When the B.H.P. Co. Ltd. acquired control

of Australian Iron & Steel Ltd. in 1935 it invited Lysaght's to take over the sheet-steel (black and coated) activities of A.I. & S. Ltd., following which Lysaght's erected the Port Kembla mill, which began production in 1938; sheet production by A.I. & S. Ltd. ceased a few months earlier, when the remaining items of sheet-rolling plant were transferred to the Lysaght's mill.

In 1939 John Lysaght Ltd. and American Rolling Mill Corporation (now Armco Steel Corporation), U.S.A., began production of bright sheet at a mill at Port Kembla, operated by Commonwealth Rolling Mills Pty. Ltd.; in 1946 Lysaght's bought the American company's interest. (The American company's branch in Australia, Armco (Aust.) Pty. Ltd., was not associated with Commonwealth Rolling Mills Pty. Ltd. other than as one of the distributors of products from the mill. Armco (Aust.) Pty. Ltd. has continued as a distributor of steel finished shapes and is a manufacturer of pre-fabricated pressed-steel buildings, culvert pipes, etc.)

Lysaght Bros. & Company Pty. Ltd., Sydney, N.S.W., now makers of wire and wire products, and dry zinc oxide, was at its establishment (for wire netting) in 1884 and for some years afterwards a branch of John Lysaght Ltd., U.K. Control by Lysaght's then lessened

as Australian capital began to enter the company, and ceased about 1905. At 1929 the company became an almost wholly-owned subsidiary of The B.H.P. Co. Ltd. and has no shareholding link with the Lysaght (of Guest, Keen & Nettlefolds) interests in Australia.

The Guest, Keen & Nettlefolds group was a considerable manufacturer of iron and steel in the United Kingdom, but the group's companies in these activities were vested in the Iron and Steel Corporation of Great Britain in 1950, following the nationalisation of the iron and steel industry of the United Kingdom. The central company, Guest, Keen & Nettlefolds Ltd., was not, however, vested in the corporation.

The Guest, Keen & Nettlefolds group in Australia consists of five companies and seven manufacturing establishments. Issued capital of the group in Australia at mid 1952 totals £4.75 million, of which £3.5 million is for Lysaght's Works Pty. Ltd., £0.75 million for Nettlefolds Pty. Ltd., and £0.25 million each for John Lysaght (Aust.) Pty. Ltd. and Joseph Sankey & Sons (Aust.) Pty. Ltd. The company structure and general activities of the group in Australia are as follows (and see also the descriptions of structure of industries, earlier this Part)—

Lysaght's Works Pty. Ltd. makes black and coated steel sheet at its mills at Newcastle and Port Kembla, N.S.W., and bright steel sheet at the mill at Port Kembla operated by the company's C.R.M. Division (see also the introduction above). Lysaght's Works Pty. Ltd. is wholly owned by John Lysaght Ltd., U.K.

John Lysaght (Aust.) Pty. Ltd. distributes the products of Lysaght's Works Pty. Ltd., including those of that company's C.R.M. Division. John Lysaght (Aust.) Pty. Ltd. is wholly owned by John Lysaght Ltd., U.K.

Joseph Sankey & Sons (Aust.) Pty. Ltd., Newcastle, N.S.W., operates a factory adjacent to Lysaght's Works Newcastle mill (where electrical steel sheet is made) for stamping-out of steel laminations for motors, generators, transformers, radio components, etc. The company is wholly owned by Joseph Sankey & Sons Ltd., U.K., itself a subsidiary company of Guest, Keen & Nettlefolds Ltd., U.K., and therefore an associate company of John Lysaght Ltd., U.K.

Nettlefolds Pty. Ltd. at its Melbourne, Vic., factory makes wood-screws, metal-thread screws and nuts, automotive valves and cycle spokes (but not nipples), and at its Sydney, N.S.W., factory makes bright bolts, nuts and setscrews. The company is wholly owned by Guest, Keen & Nettlefolds Ltd., U.K., and itself wholly owns Wire Products Pty. Ltd.

Wire Products Pty. Ltd., Sydney, N.S.W., makes bobby pins, safety pins, household pins, paper clips (of wire) and nail files. The company is wholly owned by Nettlefolds Pty. Ltd.

The Ferrous Metals Industry other than the B.H.P. Group and the Guest, Keen & Nettlefolds group

Melbourne Iron & Steel Mills Pty. Ltd., a company independent of all other companies operating steel works or steel mills in Australia, was formed in 1929 by two old-established companies. Two establishments are operated, both at Melbourne, Vic.; one is a small specialty steel works (with electric furnaces) and steel mill, the other is a mill for rolling of light sections.

K.M. Steel Products Ltd., Melbourne, Vic., manufacturers of steel window frames and

other fabrications of steel, rolls light sections for its own use.

Ferrous foundries and forges in Australia are operated by many companies and businesses, practically all unassociated with one another and not associated in company relationship with companies operating iron works, steel works and/or steel mills in Australia.

Part Two: Outline of Capacity of Manufacturing Activities

THE metals, shapes, pipes, tubes, casting and forging industries in Australia have made remarkable progress since the Australian currency was depreciated during the world-wide depression in the early 1930's. The industries owe much to being based on a good indigenous supply of most raw materials; information concerning the availability of metallic minerals is provided in this Part.

Proper appreciation of the metals, shapes, pipes, tubes, casting and forging industries in Australia requires a clear understanding of organisation and association of major companies within the ferrous and non-ferrous metals industry in Australia. Detailed comment to that end is provided at the close of Part One of this chapter.

IRON AND STEEL, FINISHED SHAPES OF STEEL, PIPES AND TUBES OF IRON AND STEEL

At the outbreak of the 1939-45 War, Australia was producing all its steel requirements except for a few items (chiefly tinplate), and was exporting considerable quantities of steel. After the war, Australian requirements increased considerably and the industry was unable to meet them, and accordingly exports were kept to a minimum. Steel has been imported in great quantity, at prices often more than double those of Australian-made steel.

Major expansion of the steel industry continued during and after the war years, together with further development of the indigenous materials on which this industry is based. In particular, ferro-alloys and bright steel sheet were produced for the first time in Australia.

At present further very big expansion programmes are being undertaken by the industry. Since the end of the war, the industry has been unable to work at full capacity because of the shortage of coal and, to a lesser extent, of labour.

An outline of major aspects of the Australian iron and steel industry is given below, under the following headings—

- Raw Materials
- Demand
- Production
- Imports
- Exports
- Capacity—Various Products
- Planned Expansion of Capacity
- Opportunities Within the Industry

RAW MATERIALS

Australia has few deposits of IRON ORE of commercial importance.

One of the two most accessible deposits of high-grade ore is at the Iron Knob/Iron Monarch area of the Middleback Range, South Australia (estimated 150 million tons). The other is at the Yampi Sound area in the north-west of Western Australia (estimated 54 million tons at Koolan Island and 19 million tons at Cockatoo Island). The B.H.P. group (through the parent company) leases and works the Middleback Range deposit; it has begun working its leases (held by A.I.S. Ltd.) over the Cockatoo Island deposit, Yampi Sound. The B.H.P. Co. Ltd. is negotiating with the Government of Western Australia for the lease of the Koolan Island deposits.

Another deposit is in Western Australia, at Koolyanobbing (near Southern Cross), which is about 25 miles to the nearest railway and 250 miles to the seaboard (Fremantle). The Wundowie charcoal pig-iron works is now using Koolyanobbing ore in increasing quantities to improve the output of its blast-furnace; the ore is a haematite, and is of much higher grade than the limonite ore (40 to 50 per cent. metal content) from a deposit near Wundowie, which is the work's main ore supply at present. There is a large deposit, at Mt. Philp (near Cloncurry) in Queensland, which has not been tested as to extent.

In Australia the great bulk of known deposits of COAL which are suitable for coking are located in New South Wales, at areas around Newcastle and Port Kembla. Nine of the pits in these deposits are owned and operated by the B.H.P. group. A fairly extensive deposit exists at Collinsville (near Bowen) and a smaller one is located at Ipswich, both in Queensland. (See also Chapter 1.)

The main source of LIMESTONE supply for the industry is the Rapid Bay deposit in South Australia. Limestone is also obtained from deposits at Attunga and Marulan, New South Wales. MAGNESITE is quarried at Fifield and Weedallion, western New South Wales, about 420 miles from Newcastle. The major source of supply of DOLOMITE for the industry is Ardrossan, South Australia. Some is also obtained from Mt. Knowles, near Mudgee, New South Wales. BAUXITE for fluxing in the open-hearth steel-furnaces is secured from the Moss Vale district, New South Wales. All these sources of supply of the major raw materials, except Weedallion and Attunga, are controlled by the B.H.P. group.

The following table gives an indication of the quantities of raw materials used and articles produced in 1948-49 and 1949-50, in blast-furnace and steel-furnace operations, when production was at a level of about two-thirds of plant capacity—

BLAST-FURNACE OPERATIONS:	1948-49	1949-50
Materials used—	tons	tons
Iron ore	1,649,288	1,764,629
Scrap iron, purchased and internal circulation	21,379	20,837
Limestone	306,145	329,037
Coke	967,876	1,004,088
Articles produced—		
Pig iron for manufacture of—		
Iron and steel	903,586	925,458
Castings	141,371	172,177
Direct Castings	15,389	14,016

STEEL-FURNACE OPERATIONS:	1948-49	1949-50
Materials used—	tons	tons
Pig iron	865,330	910,483

Demand in 1950 for finished steel products was estimated at about 2.13 million tons a year, equivalent to about 2.83 million tons of ingot steel. This demand for steel products was almost three-quarters of a million tons in excess of existing capacity and more than one million tons in excess of production.

It was estimated that demand for steel products in 1951 was about 2.5 million tons, as follows—

ESTIMATED DEMAND:	1951
	'000 tons
Heavy rails and accessories	120
Structurals, 3 in. and over	240
Plate, $\frac{1}{2}$ in. and over	250
Merchant bars—	
Light rails	635
Reinforcing rounds	
Angles, tees, bar, etc.	
Bright bar and rod	
Fencing posts	
Window sections	
Black hoop	
Wire and wire products—	
Manufacturing	130
Rope and cable	20

DEMAND

Ferro alloys	10,301	9,786
Metals (other than ferro alloys) for making alloy steels, etc.	2,091	2,314
Scrap iron and steel (purchased and works circulation)	427,697	418,937
Iron and manganiferous ores	139,158	164,109
Chrome ore	1,090	427
Other ore	1,694	1,989
Articles produced—		
Steel ingots	1,178,010	1,217,971
Direct steel castings	35,617	34,086

About 2.6 million tons of coal were used, mainly for coking but also for power and transport. Production of 1.45 million tons of ingots in 1951 would have required substantially greater quantities of raw materials.

Fencing	40	
Barbed	30	
Netting	50	
		270
Sheet products—		
Uncoated (black and bright)	250	
Coated (galvanised, zincanneal and terneplate)	214	
		464
Tinplate (a)		130
Pipe products—		
Butt weld	168	
Hot drawn	34	
Solid drawn	15	
		217
Blooms and billets (for manufacturing)		35
Cold-rolled strip		29
Alloy steel and special steel in intermediate and finished shapes		80
Total		2,470

(a) Not as yet made in Australia.

Demand has fallen substantially in 1952 because of tighter credit conditions, reduced public works activity and stock accumulations (mainly imported)—it would now be about 25 per cent. below 1951 levels, particularly in the heavier shapes and black industrial sheet.

PRODUCTION

Australian production of ingot steel in 1951 was about 1.45 million tons. On a normal pattern of production, this output would yield the following quantities of steel products—

ESTIMATED PRODUCTION:	1951
	'000 tons
Heavy rails and accessories	38
Structurals, 3 in. and over	67
Plate, $\frac{1}{2}$ in. and over	93
Merchant bars	308
Wire and wire products	142
Sheet products—	
Uncoated	157

Coated	114
Hot-drawn and cold-drawn pipe	143
Blooms and billets (for manufacturing)	28
Cold-rolled strip	22
Alloy steel and special steel in intermediate and finished shapes	38
Total	1,150

It is anticipated that output in 1952 will be higher than the 1951 level, which was a post-war record. Production in 1952-53 may reach 1.4 million tons of finished steel.

IMPORTS

Demand for steel products was far higher than Australian production, and users of steel, particularly Governmental bodies faced with pressing maintenance and developmental programmes, have been importing large quantities at prices often more than double those of Australian-made steel. For instance, the price in Australia of imported galvanised iron in August, 1952, was about £110 a ton, as against about £70 a ton for Australian galvanised

iron; and of imported plate, between £58 and £80 a ton as against £32 a ton for Australian plate. It was becoming increasingly difficult to sell very high-priced imported steel in early 1952; however, the general restrictions introduced in March, 1952, on imports may eventually change this. Pre-war and recent imports of pig iron and iron and steel products were as follows—

IMPORTS:	1938-39	1948-49	1949-50	1950-51 (a)
	tons	tons	tons	tons
Pig iron	51	nil	2,017	20,072
Rails (including fishplates, tieplates and rods)	866	14	40,736	60,492
Structural sections	1,015	6,752	79,021	102,539
Merchant bar, flats, etc. (including bright bar and rod and black hoop, band and strip, cold-drawn bar and special sections, and reinforcing rounds)	15,260	10,256	143,543	162,165
Wire rod	327	42	2,516	1,429
Blooms	186	46	1,031	1,020
Alloy steels in intermediate and finished shapes	4,983	2,484	4,430	8,439

Pipes and tubes—				
Cast iron	357	268	7,822	46,201
Butt-weld	2,232	414	11,037	
Hot-drawn	5,901	1,273	3,767	
Tubing	228	177	169	
Pipe fittings	678	127	2,018	
Sheet and plate—				
Black (including cold-rolled)	24,206	20,299	90,954	162,445
Bright (decorated, polished or further manufactured)	(b)	265	1,439	996
Galvanised	8,703	248	41,864	113,263
Terneplate	(b)	275	1,704	1,802
Tinplate	69,982	111,896	95,794	137,688
Cold-rolled strip	(b)	821	3,117	1,604
Wire and wire products—				
Wire (all types including fencing)	6,513	4,500	33,850	49,463
Barbed wire	102	730	7,617	19,497
Wire netting	24	2,072	17,327	27,906
Totals	141,614	162,959	591,773	917,021

(a) Preliminary figures. (b) Not separately recorded.

Imports of finished steel products in 1951-52 totalled about 926,000 tons, including about

155,000 tons of tinplate. All imports are now subject to licence—see Appendix II.

EXPORTS

Pre-war there was a substantial export, but, with the exception of small shipments to Pacific countries, mainly New Zealand, almost the entire production was reserved for Australian

consumption. Exports of iron ore, pig iron, scrap and iron and steel products in 1938-39, 1939-40, 1948-49 and 1949-50 were as follows—

EXPORTS:	1938-39	1939-40	1948-49	1949-50
	tons	tons	tons	tons
Iron Ore	132,203	—	27 (f)	—
Pig iron	52,321	40,536	42,251	11,001
Scrap	72,900	72,200	23,798	—
Ingot, blooms, slabs, billets	17,654	113,421	9,414	7,233
Rail and Tramway track material	(a)	(e)	2,720	2,678
Structural steel	9,653 (b)	6,402	5,667	4,643
Merchant bar, rod, etc. (including black hoop, band and strip, reinforcing round)	104,734 (c)	161,272	13,473	9,351
Wire rod	(d)	—	101	—
Pipes and tubes (including fittings)—				
Cast iron	(a)	1,253	1,009	563
Other	(a)	2,049	14,451	9,981
Plate and sheet—				
Black, including motor body	11,310	27,962	5,745	3,510
Galvanised	1,605	57,953	4,069	2,085
Polished, decorated or further manufactured	(e)	(e)	70	77
Terneplate and tinplate	161	16	—	118
Wire (all types including fencing)	10,944	7,924	2,335	1,470
Barbed wire	842	2,212	16	19
Wire netting	1,330	2,371	4	170
Castings and forgings	(e)	(e)	(a)	(a)

(a) Tonnage not available.

(b) Excluding angles and tees.

(c) Including angles and tees.

(d) Included under Merchant Bar.

(e) Not separately recorded.

(f) Ores and concentrates.

Between 1928-29 and 1938-39 about 2½ million tons of iron ore from Iron Monarch, S.A., were exported overseas. This ore (of high manganese content) was in excess of requirements for smelting in the Newcastle blast furnaces. However, following an extensive survey of Australia's ore reserves, the Commonwealth Government placed a ban on the export of iron ore as from July, 1938.

The year 1939-40 was the peak year for steel exports, a total of 479,929 tons of iron and steel items being exported in that year. Exports gradually declined during the war period to a low of 44,061 tons in 1943-44, but rose to a post-war peak of 329,141 tons in 1946-47. Post-war shortages within Australia have necessitated the continuance of war-time controls on exports notwithstanding the great potential export market available; exports have fallen from the post-war peak of 329,141 tons to 105,922 tons in 1947-48, 107,979 tons in 1948-49 and 53,000 tons in 1949-50.

In the exercise of export control efforts have been made to maintain supplies of steel finished shapes to near markets, particularly New Zea-

land. Allocations have accordingly been made to permit the export of certain items such as sheet, pipe and wire on a quota basis and, in addition, to permit the annual export of limited quantities of some other steel products. Shipping problems have generally prevented this level of export being achieved.

Exports have been greatly below the potential overseas markets for Australian steel products. Minimum requirements for New Zealand alone for 1951 were estimated at not less than 200,000 tons of all types of steel. Similarly, the demand for steel from the islands of the south-west Pacific was estimated at 10,000 tons during 1951, including over 5,000 tons of galvanised iron. Only a small part of this demand has been satisfied to date. There are also large potential markets for Australian steel in countries such as India, Ceylon, Malaya, Hong Kong and South Africa. Beginning about mid-1952, increasing Australian production and a reduced level of consumption permitted the re-establishment of exports of pig iron and of some steel products.

CAPACITY—VARIOUS PRODUCTS

In early 1952, Australia's installed capacity for the production of PIG IRON was about 1.76 million tons a year. There were seven blast furnaces—three at Newcastle, two at Port Kembla, one at Whyalla, and a charcoal-iron furnace at Wundowie. The bulk of iron production is used in the manufacture of steel.

It is estimated that the quantity of basic iron required to produce sufficient steel products to meet the Australian demand in 1951 would be about 2.5 million tons, provided about 20 per cent. scrap were used in steel making. In addition, estimated requirements for general purpose castings are about 320,000 tons. Total potential demand for 1951, then, is estimated at about 2.8 million tons, compared with capacity of only about 1.76 million tons. Total actual pig iron production in 1950 was about 1.3 million tons. Increased iron production and increased usage of scrap is meeting the reduced demand in 1952.

Total present installed capacity for STEEL PRODUCTION is estimated at about 1.95 million ingot tons a year. However, production in 1951 was only about 1.45 million ingot tons, or about 74 per cent. of present installed capacity. This quantity of ingot steel would yield about 1.1 million tons of finished steel products. Production since the close of the 1939-45 War has rarely been above 70 per cent of capacity, mainly due to the shortage of coking coal, and to a lesser extent, labour. The position for 1952 looks brighter.

To operate at full capacity in 1950, the steel-works would have required about 3.3 million tons of coal, including coal required for ancillary operations, but secured only about three-quarters (2.6 million tons) of requirement because of under-production of coal in the face of the greatly increased and urgent demands for coal by industry in general; in other words, the steel industry is being given a ration. Therefore, for full production of steel alone, it is necessary that annual production of coal in 1952 be increased by about half a million tons. Intensive organisation and development is proceeding at the coalfields to secure that increase and much more (see Chapter 1, "Fuels, Lubricants, Light, Power"). Also, large quantities of coal are being imported, and re-allocation of New South Wales coal is being effected to release more coking coal to the steel works.

Ferro-alloys

Ferro-alloys are made mainly at a plant at the B.H.P. Newcastle iron and steel works. The plant is capable of producing all the ferro-alloys required in the manufacture of alloy steels. Demand, however, for certain types of ferro-alloys is insufficient to maintain continuous production, and generally only the tonnage alloys such as ferro-silicon, ferro-manganese, ferro-chrome and, occasionally, ferro-silicon-zirconium are made. Imports of ferro-alloys in recent years were—

IMPORTS:	1949-50 1950-51	
	tons	tons
Ferro-alloys, unworked (mainly in lump form)—		
Ferro-manganese, including powder	578	273
Ferro-molybdenum	11	29
Ferro-nickel	4	1
Ferro-chromium	3,015	770
Ferro-alloys, not elsewhere provided for	658	738

Alloy Steels

There is electric-furnace capacity in Australia

capable of producing about 60,000 tons of alloy steels a year. There is sufficient rolling capacity to convert this into rounds, flats, squares, hexagons, sections, plates and sheets. Subsequent machining and forging is also carried on at the works of the producers, as well as by the manufacturers of finished products from alloy steels. A small part of the output of alloy steels is poured direct for castings. In addition, there are about 35 foundries which produce some 10,000 tons a year of general-purpose alloy-steel castings from material alloyed in their own works.

Finished Shapes (including Pipes and Tubes)

Serious shortages in most finished shapes have persisted in the post-war years. Although these shortages have been aggravated by the scarcity of coal and labour at the iron and steel works, the present demand for the products of the steel mills is nearly double the production and even greatly in excess of the existing rolling and drawing capacity. There is, however, no shortage of capacity to make Australian requirements of steel pipes and tubes (and fittings), and of steel wire. The only significant product in this group which is not yet being produced in Australia is TINPLATE, and a plant is now being installed to make it. The overall capacity for the production of finished shapes is insufficient to meet all demands, and although all types of these products can be made, some, in fact, are not being supplied, because of the pressure on productive capacity. (For imports of finished shapes, see table earlier this Part.)

Over recent years, production of MERCHANT BARS, RAILS, PLATE and STRUCTURALS has been much lower than demand. The availability of feed, including the feed required by other producers, will determine the level of operation of the mills making these products. Under a normal pattern of production, the capacity of these mills would be sufficient to meet nearly three-quarters of total Australian requirements. It is expected that increased quantities of feed will be available to steel mills late in 1952. In addition, capacity for making rails and structurals will be increased by the elimination of the common drive between the structural and rail mill and the continuous mill at Port Kembla; the new hot and cold strip mill at Port Kembla will begin rolling plate about mid-1954 and strip in 1955. Production should, in late 1952 or early 1953, be much nearer to meeting demand.

SHEET-ROLLING CAPACITY (inclusive of all types made) is equal to about 75 per cent. of the present demand, while production—which is determined by the tonnage of sheet bar that is available from the steel mills at the iron and steel works—is only about two-thirds of demand. Plans have been prepared which will progressively bridge the gap between present overall rolling capacity and estimated demand during the next four to five years. It is expected that present sheet-rolling capacity will eventually be more than doubled. The major portion of output consists of GALVANISED IRON; BLACK SHEET; MOTOR-BODY and other deep-drawing and enamelling sheets, generally termed BRIGHT SHEET; TERNE-PLATE; and "ZINCANNEAL" SHEET. Current production of each item is equal to about two-thirds of demand. In special black steels such as agricultural-disc steel and high-carbon quality steels, output is considerably below

demand. Capacity to manufacture low-quality and medium-quality SILICON-STEEL SHEET exceeds the Australian demand. Production of high-grade TRANSFORMER SHEET is to be expanded shortly. STAINLESS-STEEL SHEET is produced in Australia, but not in gauges lighter than 22 S.W.G. The subsidiary company of the B.H.P. group, which is the only producer of stainless-steel sheet in Australia, has recently increased its rolling capacity. Plans are being developed by this company to increase production of other alloy steels.

The demand for STEEL PIPES, TUBES and FITTINGS could be satisfied by the manufacturers, whose capacity exceeds their present production rate. The two producers of pipe and tube are associated with the B.H.P. group, and they operate three large and efficient plants. Products made include steel tubes up to 3½ inches outside diameter, manufactured by the butt-welding process; seamless hot-drawn pipes up to 8½ inches outside diameter made by the push-bench process; wrought-iron and malleable fittings; seamless and electrical-welded steel precision tubes. Stainless-steel and alloy-steel tubing is not made in Australia. Capacity for the manufacture of FABRICATED STEEL PIPE is sufficient to meet present requirements, but actual production is below capacity, mainly because of the difficulty of obtaining sufficient steel plate. Imports of pipes and fittings in recent years were—

IMPORTS:	1949-50	1950-51
	cwt.	cwt.
Pipes and Tubes—		
Boiler tubes	7,152	15,403
Close-jointed iron or steel pipes and tubes	17,150	26,331
Water bore casings	4,517	2,762
Welded conduit pipes and tubes	18,689	43,777
Iron and steel pipes and tubes, n.e.i.—		
Not over 3 inches internal diameter	221,886	378,487
Over 3 inches and not exceeding 6 inches internal diameter	14,663	12,612

Exceeding 6 inches internal diameter	23,660	46,715
Plated, polished or decorated	2,291	2,553
Fittings for Pipes and Tubes—		
Fittings for electrical conduit—		
Grip types	896	—
Screwed types (malleable cast iron)	766	4,670
Steel, wrought iron and malleable cast iron fittings for pipes and tubes, n.e.i.	2,941	7,605

The level of production of STEEL WIRE in wire mills (such as Rylands and Lysaght Bros.) is dependent on the supply of wire drawing rod from the steel mills of The Broken Hill Proprietary Co. Ltd. The wire mills produce fencing wire, barbed wire, woven wire, and bright drawn wires, as well as galvanised, tinned, coppered and tyre bead wires. In addition these mills supply plain drawn wire to other wire fabricators which make nails, screws, woven wire, gauzes, etc. In recent years there have been heavy imports of wire and wire products. However, in 1952, with a fall in demand and increased production (aided by better supplies of zinc), the supply position has been improving and some uncoated wire and wire products have been exported. Imports of iron and steel wires in recent years were—

IMPORTS:	1949-50	1950-51
	cwt.	cwt.
Iron and Steel Wire—		
No. 15 or finer gauge I.S.W.G.—		
Plain—hardened tempered or annealed	10,404	9,763
Plain otherwise	3,377	8,405
Galvanised, tinned or coated	61,528	45,659
N.E.I.	23,456	19,252
Gauges coarser than no. 15 (I.S.W.G.)—		
Fencing, gauges no. 8 to 14 (I.S.W.G.) inclusive	205,923	487,593
Steel nail wire (heavier than no. 15)	58,765	13,715
Other, plain	10,332	19,121
Other, galvanised, tinned or coated	217,678	295,411
N.E.I.	98,758	91,838

(See Chapter 12 for comment on wireworking in Australia, also the manufacture of bolts and nuts, screws and chain.)

PLANNED EXPANSION OF CAPACITY

The Broken Hill Pty. Co. Ltd. (parent and central company of the B.H.P. group): Continued building of bulk-ore carrying vessels for transport of the group's materials and products (see Chapter 10). — Erection now under way of 68 new coke-ovens, in a fourth battery, initially to replace ovens which are to be rebuilt, progressively, but which will ultimately add about 30 per cent. to coking capacity at the steelworks, Newcastle. — Proceeding with plans for erection of a fourth blast-furnace, of about 1,000 tons a day capacity, which is greater than any one of the other three blast-furnaces. (With iron expansion by A.I. & S. Ltd., the total iron capacity in Australia will be increased from 1.76 million tons to about 2.61 million tons a year.) — New pipe-skelp mill has been planned; also additional capacity for wire-rod. — A subsidiary company, Commonwealth Steel Co. Ltd., which has recently increased its stainless-steel capacity and forging capacity, is installing a new foundry and an additional and very large forging press. — Another subsidiary, Rylands Bros. (Aust.) Pty. Ltd. (with a wire mill at Newcastle) is erecting a wire mill in Victoria (the first of its kind in that State) which will be in production by early 1953. — Development of a new seam at Stockton Borehole coal mine. —

The B.H.P. Co. Ltd. also has in mind the establishment eventually of a small but completely integrated steelworks at Whyalla, South Australia. At this ore-shipping port there exists the nucleus for such a works, consisting of wharf facilities, a blast furnace, an electric steel furnace and machine shops. However, its planning will take some years, while an increase in the supply of fresh water and homes for housing the additional population required at Whyalla must take precedence. Meanwhile, the steel industry is fully occupied with its major expansions at the other centres. — The B.H.P. Co. Ltd. proposes to establish a merchant rolling mill of 50,000 tons capacity at Kwinana, near Fremantle, in Western Australia.

Australian Iron & Steel Ltd. (principal subsidiary company of The B.H.P. Co. Ltd.): A highly-mechanised quarry has been established at the Cockatoo Island iron-ore deposits. — Extensive development of the collieries, including mechanisation, is well under way. — Coke-oven capacity at Port Kembla is being extended by 24 ovens. Early in 1953, 144 coke-ovens will be in operation, if plans for increasing coal output are in operation. — A third blast-furnace, annual capacity about 500,000 tons of pig-iron, about 1,500 tons a day nominal capacity, was blown in at August 1952. —

Two additional open-hearth furnaces are to be built, and the first is expected to be in use early in 1953. These furnaces, together with additions to existing plant, will increase total open-hearth furnace capacity in Australia from about 1.95 million ingot tons to about 2.4 million ingot tons, a year. The achievement of the estimated figures given above assume an improvement in the available supply of coal and labour. (The increase in capacity to produce steel ingot will be available for the expansion in rolling and processing capacity detailed below.) — The blooming mill is being altered to increase its capacity. The major rolling mill extension scheduled, within the next decade, is the construction of a large hot and cold continuous strip and tinplate mill at Port Kembla which will have an annual productive capacity of over one million tons of flat steel products. Construction began in 1949 with the preparation of the site; some of the buildings have already been completed. This new mill would be able to produce eventually all the tinplate for known requirements, and the mill feed needed for production of coated and uncoated steel sheets by Lysaght's Port Kembla Works. Any surplus capacity of the new mill would be available as steel plate or as reserve capacity against future development. This capacity for one million tons of flat steel products will not be all additional capacity. When the hot and cold continuous strip mill is installed, some adjustment of rolling capacity in the existing mills will be necessary. Perhaps in the following decade, as the hot and cold strip mill plant is further extended, a further group of furnaces

and rolling mills will be required. Completion of the basic elements of this major project is scheduled for 1955.

Lysaght's Works Pty. Ltd.: Commonwealth Rolling Mills Division (at Port Kembla) has recently installed a modern reversing cold mill that will double present capacity of steel sheet of bright finished, deep drawing and enamelling varieties when coiled strip is available as feed. — Lysaght's, Port Kembla, mill is planning a very large extension to increase output of galvanised iron and black steel sheet. It has recently begun construction of a new sheet mill which eventually would take strip from the hot section of the proposed hot and cold strip mill of Australian Iron and Steel Ltd. and reduce it cold in strip form from about 16 gauge, instead of using sheet bar as primary mill feed as at present. The sheet-rolling capacity of this plant would then be raised to more than twice its present capacity. Additional finishing capacity will be provided for hot-rolled heavy-gauge sheet. If present plans are realised the new sheet mill should be in operation in 1955. — Lysaght's is adding 25,000 tons to its present rolling capacity at the Newcastle mill, and this is likely to be available in November, 1952.

Others: Wire-drawing, wire-weaving and wire-products mills will find it possible to increase output from their existing plants as more feed becomes available from steel-works. — The Wundowie charcoal-iron works is planning to increase its capacity to between 15,000 and 16,000 tons a year.

OPPORTUNITIES WITHIN THE INDUSTRY

The sustained demand for Australian-made steel, together with the competitive price at which Australian steel can be exported, indicates that quite favourable market conditions exist for expansion of the steel industry. Although particular steel products may be in ample supply at odd times, overall it is apparent that for many years to come Australia's rural, manufacturing and service industries must rely on overseas supplies for a significant portion of their requirements of steel products. The position would become critical if at any time overseas steel supplies become seriously curtailed.

Indications are that opportunities for expansion of the iron and steel industry will continue to present themselves possibly for an indefinite period. Plans for national development are on a very large scale, while industry generally is developing new capacity and technique which require greater supplies of steel. The rural industries have become increasingly conscious of the value of "all-steel" construction.

The major prospective development of the B.H.P. group, to take place mainly in South Australia and New South Wales, has been outlined above. This expansion by no means exhausts the possibilities.

The ingot-steel and rolling-mill capacity of States other than New South Wales is small indeed—about 8,000 tons a year of ingot steel are produced in Victoria. However, the lessening of centralisation began with placement of a blast-furnace at Whyalla in South Australia with the intention to eventually add a steel-works; there was shrewd judgement in such placement and probably also in the intention, because Whyalla is well placed in the economic, well-organised "make-a-good-best-of-what-we-have-where-it-is" system developed by the

B.H.P. group. That same problem, only more so, of making a competitive "best" of widely separated indigenous materials, and of fitting that "best" into an economic location with regard to market and labour, faces the newcomer desiring to establish an integrated iron and steel works in Australia. The additional or alternative possibility of basing an iron and steel works on imported ore may need to be closely examined.

The most accessible economically workable deposit of iron ore in Australia not leased by the B.H.P. group is the Koolan Island deposit at Yampi Sound, in the north-west of Western Australia; the unleased deposit is estimated to contain between 50 and 100 million tons of high-grade haematite ore. The B.H.P. group has begun shipping ore from the deposit on nearby Cockatoo Island, which it has on lease, and is negotiating with the Western Australian Government for a leasehold of the Koolan Island deposit. Yampi Sound is a ten-day to twelve-day haul by sea to the eastern coastline, where in circumscribed areas all the coking coal and the greater part of the industry and population of Australia are located. Return travel in ballast for a long portion of the distance is unavoidable because of the almost completely unsettled nature of the north-west of Western Australia, and the relatively small population generally of Western Australia, and northern Australia.

The State Government of Queensland has in the past shown a desire to establish, or to have established, at or near Bowen, an iron and steel works and steel mills, drawing upon local coal and limestone. Present thought is that the works could operate satisfactorily on an ore supply secured from elsewhere in Australia than Queensland; there is, however, the deposit of

ore at Mt. Philp, reported to be of economically workable size, though possibly not as economically accessible as sea-borne ore, either of Australian or overseas origin. The State of Queensland, particularly in its central and northern coastal regions, has the greatest latent development possibilities in Australia, and in fact is at present rapidly expanding in population, agriculture and, to lesser extent as yet, manufacturing.

The State of Victoria, and in particular the intensively industrialised metropolis of Melbourne, is by far the greatest steel-consuming area in Australia, other than the Sydney-Newcastle-Wollongong area of New South Wales where the two integrated iron and steel works and steel mills are located. Victoria, however, has no coking coal—very little black coal at all—and no known iron-ore deposits of commercial significance (see Chapter 1). There does appear to be opportunity at Melbourne

for expansion of existing rolling-mill capacity. There is a demand there for light sections, such as merchant bars and rods, for general manufacturing uses, far in excess of the output of the three small mills now in operation.

Production at the Wundowie charcoal-iron works is an integral part of the wood-destructive distillation, and its extension depends upon that activity. Experiments with briquetted coal from the Collie coalfield (about 150 miles by rail from Wundowie) towards increasing its coking properties to a quality suited for blast-furnace use are proceeding satisfactorily. If a good coke can be obtained from Collie coal the possibility of briquette-coke and Koolyanobbing ore being utilised for a small integrated iron and steel works in the south-west of Western Australia is worthy of note. The possibility of using Collie coal to make iron by the low-shaft furnace process is also being examined.

NON-FERROUS METALS AND FINISHED SHAPES OF NON-FERROUS METALS AND ALLOYS

Preceding the description of capacity in Australia for refining of non-ferrous metals (including precious metals) and manufacture of such metals into finished shapes, information is provided as to the availability of non-ferrous metallic minerals. Much of the information (including statistics, which in main are for calendar years) concerning resources of metallic minerals and of production and usage of re-

finished metals has been provided by the Bureau of Mineral Resources, Geology and Geophysics, of the Department of National Development. (Specific enquiries concerning mineral resources should be addressed to the Bureau—see Appendix II.) The minerals are dealt with below in three groups of metals derived from the minerals—Major Base Metals, Minor Base Metals, Precious Metals.

Availability of Non-ferrous Metallic Minerals

FOR MAJOR BASE METALS

ALUMINIUM COPPER

LEAD TIN

ZINC

Aluminium

This metal is not yet produced in Australia and no bauxite mining of any consequence is undertaken (other than the mining of bauxite in the Boolara-Mirboo North area in Victoria for chemical manufacture—see "Non-Metallic Minerals", Chapter 2). Considerable reserves of bauxite suitable for aluminium manufacture are known. Economic deposits exist in at least three States, and the leases now under the control of the Australian Aluminium Production Commission (a Commonwealth Government authority) amount to 8.6 million tons. Total known reserves of economic value amount to nearly 20 million tons, and in addition there are other reserves (including Western Australia) as yet unproven. A recent discovery in Northern Territory will add to these reserves. Approximate tonnages of the principal reserves with their approximate values are as follows—

RESERVES:	Quantity '000 tons	Maximum Available Alumina %	Minimum Silica %	Minimum Iron Oxide %	Minimum Titanium %
Boolara—					
Mirboo Nth, Vic.	735	50	8	7.5	5.5
Ouse and St. Leonard's Tas.	878	40	6.25	—	—
Inverell, Tingha and Emmaville, N.S.W.	12,830	39	4	30	4
Bundanoon—Wingello, N.S.W.	4,113	35	5.75	30	4.75
Total	18,556	—	—	—	—

Alunite deposits in Australia are not considered a potential source of aluminium.

Copper

Australia ranks last among the twenty-six recognised copper-producing countries. In 1948, Australian production contributed only 11,389 tons out of the total world production of 2,200,000 tons, and as would be expected, reserves of copper-bearing ores are not large. Estimates prepared in 1949 (exclusive of Cobar) were as follows—

RESERVES:	Quantity '000 tons	Copper %	Copper Content '000 tons	Probable Recoverable Copper '000 tons	Annual Output '000 tons	Life Years
Mt. Isa . . .	2,295	4.02	119.0	108.0 (a)	17.00	7
Mt. Morgan	5,212	1.93	113.0	95.0	5.50	13-17
Mt. Morgan	1,987	0.47	241.0	200.0	10.00	20
Mt. Lyell	33,000	0.73	9.4	6.6	.65	10
Captain's Flat	1,570	0.60	7.2	3.6	.40	9
Read-Rosebery . . .	1,500	0.48	413.2	33.55	—	—
Totals . . .	45,564	1.00	489.6	413.2	33.55	—
(approx.)						

(a) Expected output.

The reserves quoted represent merely developed ore; the ultimate reserves are greater, but not proven.

At Mt. Lyell Mining & Railway Co. Ltd., Queenstown, Tasmania, production is taken right through to electrolytic copper, most of

the cathode copper so produced being shipped to the copper refinery at Port Kembla for casting into shapes. Mt. Lyell has decided to step up production by the addition of further equipment in the open cut, and it is estimated that, by 1953, output will be of the order of 10,000 tons of refined copper a year, if coke and shipping are available.

At Mount Morgan Ltd., Mt. Morgan, Qld., the copper concentrate (with considerable gold content) is smelted to blister copper, which is forwarded to Port Kembla for electrolytic refining. Recently, additional reserves of ore have been discovered.

New Occidental Gold Mines N.L., at Cobar, N.S.W., rails its concentrate to Port Kembla for smelting and electrolytic refining. At present production is small, and current operations may cease. An extensive prospecting campaign has been started and future operations will depend upon final results.

Lake George Mines Pty. Ltd., Captain's Flat, N.S.W., rails its concentrate to Port Kembla for smelting and electrolytic refining.

Small producers in Queensland and Northern Territory sell their ore to Mount Morgan Ltd. Their production is included in the total figures from Mt. Morgan.

Copper speiss and matte from Port Pirie are also shipped to Port Kembla for electrolytic refining, as are also dewatered tank-house slimes from Mt. Lyell.

Lead-copper drosses from Mt. Isa, lead-copper concentrate from the lead zinc ores at Read-Rosebery, and occasionally lead-copper speiss from the Port Pirie smelter, are exported to the United States of America where the smelters (buyers) pay for both the copper and lead content. These exports are made because there is as yet no provision at Port Kembla for the recovery of lead from these products.

Mount Isa Mines Ltd., a zinc-lead producer, anticipates with the erection of its copper mill and smelter by the end of 1952 to commence mining of its copper ore body with an objective output of 36,000 tons of ore a month, to produce about 17,000 to 18,000 tons of blister copper a year.

Lead

Australia is regarded as third in importance of the world's lead-producing countries, and in 1950 produced 219,176 tons of lead. Reserves of lead-bearing ores are considerable. The reserves of the principal fields are as follows—

RESERVES:	Quantity	Lead	Year
	'000 tons	%	Estimated
Mt. Isa	7,312	8.6	1946
Broken Hill	11,055	16.0	1946
Captain's Flat	1,328	7.2	1946
Read-Rosebery	1,500	6.4	1943

Reserves quoted represent developed ore; ultimate reserves are greater, but unproven.

Broken Hill ores, which contribute some 80 per cent. of total Australian output, are concentrated on site to about 76 per cent. lead and 30 ozs. of silver a ton and railed to the smelter refinery of The Broken Hill Associated Smelters Pty. Ltd. at Port Pirie, S.A., for refining to market lead (99.99 per cent. lead) and the recovery of gold, silver, antimony and cadmium content. Mount Isa ore is concentrated and smelted to lead bullion and shipped to the United Kingdom for refining. Silver-lead residues from zinc refining at Risdon (from Rosebery and Hercules zinc ores, Broken Hill zinc concentrate, and Broken Hill calcine reshipped

from the various acid works) are also shipped to Port Pirie for smelting as is the output from nearly all small producers. Lead ores from Lake George Gold Mines N.L. (Captain's Flat) and Rosebery are concentrated and railed to nearest coastal port for export, usually Rosebery concentrate to the United States and Lake George concentrate to Belgium.

The greatest proportion of lead concentrate produced is sintered and smelted at the only refinery in Australia, at Port Pirie (owned by The Broken Hill Associated Smelters Pty. Ltd.) to produce base lead bullion and then refined. The refinery is unique in two respects. It is the largest in the world, and is the only refinery operating on a continuous process. During the processing, the silver and gold contained are extracted in a high state of purity, copper is produced as a matte containing 66 per cent. copper and 10 per cent. lead, and antimony as an antimonial slag containing 25 per cent. antimony.

Tin

Australian tin production is not of great significance in world output, amounting on the average to about 1 per cent.—production in 1949 was 1,955 tons (world production, 161,300 tons). Production normally is derived from about sixty producers from numerous districts, most of whom are relatively small. Comprehensive data on tin resources is not readily available. Present leading producers are Tableland Tin Dredge in Queensland followed by Aberfoyle lode mine (in 1949 these two producers contributed 40 per cent. of the total tin concentrate); Endurance alluvial mine, and the Renison Associated lode mine, Tasmania. Reserves in most of these mines are adequate to maintain their present rates of production for a number of years—predicted output is 1,500 to 2,000 tons a year—although Tableland Tin Dredge is moving to another area. Much of the production is interdependent on the mining of tungsten, molybdenum and bismuth, consequently a high price for any one of these metals frequently stimulates tin output, and conversely attractive returns for tin are reflected in increased output of the associated ores. Queensland (principal producing State) derives its output from both lode and alluvial resources as do the States of New South Wales (third producing State) and Victoria. There is only one producer in Victoria, reputedly operating the largest dredge in the world on a deposit bearing tin and gold. In Tasmania (which shares first place with Queensland) tin mining is in some mines associated with that of tungsten. Western Australia, where some of the tin is recovered in conjunction with tantalite production, and Northern Territory, are small producers.

Zinc

Australia is an important producer of zinc concentrate and refined zinc (usually regarded as fifth in order of world production) and possesses considerable reserves of these ores, which when estimated in 1949 were as follows—

RESERVES:	Quantity	Zinc
	'000 tons	%
Mt. Isa (one mine)	7,312	8.5
Captain's Flat (Lake George Mine) (one mine)	1,328	12.8
Read-Rosebery (two mines)	1,500	20.0
Broken Hill (four mines)	11,055	12.0
Total	21,195	—

Production is practically confined to the four fields mentioned above, and about 50 per cent. of the concentrates they produce is treated in Australia. Output of zinc in concentrates in

1950 was 202,384 tons. About 25 per cent. of the zinc concentrate produced from the mines of Broken Hill South Ltd. and North Broken Hill Ltd. is shipped via Port Pirie to Risdon (Tasmania) for roasting and refining, and the remainder from those two mines is distributed to fertiliser plants in South Australia, Victoria and New South Wales for roasting (see "Sulphuric Acid", Chapter 6) before final shipment as zinc calcine (about 100,000 tons handled this way in 1949) to Risdon for refining. The zinc

concentrate produced from the Zinc Corporation mine (at Broken Hill) and the New Broken Hill Consolidated mine is all shipped via Port Pirie to the United Kingdom for roasting and distillation refining by the Consolidated Zinc Corporation group. The output of ores from these two mines is to be doubled in the next five years. Read-Rosebery zinc concentrate is railed to Risdon. Mt. Isa and Lake George Mines (Captain's Flat) zinc concentrate is railed to the nearest sea ports for export overseas.

FOR MINOR INDUSTRIAL METALS

ANTIMONY
BERYLLIUM
BISMUTH
CADMIUM
COBALT

MANGANESE
MERCURY
MOLYBDENUM
NICKEL
SELENIUM

TANTALUM, COLUMBIUM
and NIOBIUM
THORIUM and CERIUM
TUNGSTEN

Antimony

Australia is not a large producer of antimony ore, ranking eighth among the principal producing countries and contributing on an average only about 2 per cent. of world production. The largest and most regular contribution is in the form of 10 per cent. antimonial-lead from antimonial slag obtained in lead refining (the production of antimonial lead bears a regular ratio to the amount of Broken Hill lead smelted at Port Pirie). Other sources are hand-picked stibnite ore, stibnite concentrate and auriferous-stibnite concentrate (most of the Western Australian antimony concentrates are in this category, but the gold-content, up to 10 ozs. a ton, renders them unsuitable for certain avenues of normal usage). The deposits are widely scattered and the ore reserves are small. New South Wales is at present the largest producing State. Western Australia and Queensland also contribute, but Victoria, formerly pre-eminent, contributes little. Total production for a number of years has been considerably less than demand and imported concentrate is utilised to make good the deficiency. Production of antimony ores and concentrate in 1950 was 471 tons.

Beryllium

Small quantities of beryllium mineral (the only present commercial Australian source is beryl) have been mined in Australia. There is, however, a decreasing production tendency, and output in 1950 was only 23 tons. Most of the production is associated with other mining activities (e.g., mica, feldspar and tantalite). Reserves are unknown, but are thought to be small. Production, though perhaps stimulated by recent price offers from the only present buyer, the British Ministry of Supply, cannot be very great.

Bismuth

Australian production of bismuth in concentrates has declined from about 80 cwt. in 1948 to only 18 cwt. in 1950. New South Wales contributed most of this output, mainly from the treatment of old wolfram dumps at Torrington. In Queensland, the only other producing State, production was confined to small mines on the Chillagoe and Mareeba fields in the Cairns hinterland.

Cadmium

Australia is an important producer of cadmium, ranking fourth among the principal producing countries and contributing about 5 per cent. of world production (excluding U.S.S.R.). Deposits of pure cadmium ores are unknown. The chief world sources are zinc ores (spha-

lerite containing about 0.18 per cent. of cadmium). In Australia, the zinc concentrate (and to a lesser extent, lead concentrate) from Broken Hill and Read-Rosebery mines provide the only source of supply.

The Electrolytic Zinc Company of Australasia Ltd. is the only cadmium marketing organisation in Australia. Exact local requirements for cadmium are unknown, but are probably in the region of 150 tons a year, with a tendency to increase. Its greatest use is in its metallic form for electroplating. Based on United Kingdom estimates in 1949, Australian consumption by usage would probably be in the following order—

Plating anodes	40.00%	Alkaline batteries	13.75%
Plating salts	6.75%	Dry batteries	2.00%
Cadmium-copper alloys	13.25%	Solder	2.50%
Other alloys	2.25%	Pigments	16.00%
		Miscellaneous	3.50%

Production of cadmium in Australia is above current consumption and quantities are regularly exported (mostly to United Kingdom). Exports for four years ending 1950 were: 1947, 96 tons; 1948, 87 tons; 1949, 174 tons; 1950, 161 tons. In addition, the lead and zinc concentrates exported from Broken Hill, Captain's Flat and Tasmania (to United Kingdom, United States, Belgium and Norway) contain considerable amounts of cadmium. Exports in these concentrates amount to something like 300 to 400 tons a year.

Cobalt

Known economic resources of cobalt ores in Australia are practically non-existent. Production, which in former years was obtained from Cloncurry area, Queensland (Cobaltite) and northern New South Wales (Asbolite and Glauco-dot), has practically ceased from these sources. In the early part of the century, New South Wales was regarded as the world's second largest producer of cobalt ores. During the past twenty years, all Australian production has been in the form of a 65 per cent. oxide (during the 1939-45 War, some metal was produced) recovered from electrolytic refining at Risdon of zinc concentrate from Broken Hill and Read-Rosebery. The principal use in Australia is in the manufacture of alloys, paint driers, ceramic glazes and salt licks, and in agriculture. Australian future production will follow the production of zinc.

Manganese

Manganese ores in the three principal classifications required are mined in Australia, though in both quantity and gradings they have been inadequate to satisfy demand. There are three

types. Manganiferous iron-ore (manganiferous hematite) containing between 5 and 10 per cent. manganese dioxide, is used in the manufacture of manganiferous pig-iron and mild steel. Higher grades (14 per cent. or better) are used in conjunction with metallurgical ore in the manufacture of ferro-manganese. Pyroxulite battery ore must contain not less than 75 per cent. manganese dioxide.

Manganiferous iron ore is mined exclusively by The Broken Hill Pty. Co. Ltd., from its own deposit at Iron Monarch, S.A., for use in iron and steel plants of the B.H.P. group. For a number of years mining has been at a reasonably constant rate of some 300,000 tons a year, which satisfies all requirements, and reserves are adequate to maintain this rate.

Requirements of metallurgical ore are met partly from imports and partly from Mt. Fraser (one mine, owned by The Broken Hill Pty. Co. Ltd.) in the Peak Hill district, W.A. Deposits there, whilst not over extensive, are estimated to contain about $\frac{1}{2}$ million tons of ore containing 44 to 48 per cent. manganese.

Requirements of battery ore have in the past been partly supplied from deposits in the New England district, N.S.W., and Queensland, and partly from importations from Papua, India and U.S.S.R.

Manganese ores for miscellaneous uses such as a colouring agent in pigments, bricks, tiles, glass, ceramic enamels, etc., as a trace fertiliser element, and as an aid in the manufacture of oxywelding equipment, etc., can generally be satisfied from ores of Australian origin, as the specification for these uses is neither high nor rigid. Recent annual consumption has been as follows: Metallurgical ore, 7,000 tons; battery grade, 2,000 tons; and miscellaneous uses, 400 tons.

In addition to normal mining procedure, about 1,000 tons a year of manganese mud (containing about 54 per cent. manganese dioxide) is recovered as a by-product in the refining of zinc concentrates at Risdon (see "Zinc"). This is used in the manufacture of chemicals, paint driers, etc., and might, after suitable treatment, be available for battery use.

Mercury (Quicksilver)

Occurrences of mercury (native) and cinnibar (the principal ore) are known and deposits have been worked. Production has ceased and there are no indications that any economic deposits exist. Australian requirements for metallic mercury and mercury salts are met by importations, which in 1949-50 were as follows: Mercury, 44,726 lbs. (principally from Italy and Spain); and mercury salts, 94,140 lbs. (principally from United Kingdom).

Molybdenum

Australia produces small amounts of molybdenite concentrate obtained from mines in New South Wales and Queensland. Production in 1950 was 5 tons, compared with 5.9 tons in 1949, 3 $\frac{1}{2}$ tons in 1948 and 4 tons in 1947. Molybdenite is consumed in Australia mainly as ferro-molybdenum for molybdenum steels. A little is used for fertiliser purposes and pigments, and small amounts of molybdic-oxide briquettes are used.

Nickel

Known Australian resources are few and small. Small sulphide deposits containing pentlandite exist near Zeehan, Tas.; the ore body has been worked, but many difficulties—e.g., the ore

is subject to spontaneous combustion—have precluded its thorough exploitation. The principal use for nickel is in the form of an alloy in stainless steel, monel metal, etc., and as a chemical (nickel sulphate, etc.) in electroplating. All present requirements are imported (metal from Canada and chemicals from the United Kingdom) and are estimated to amount (total metal and chemicals) to the equivalent of 750 tons of metal a year.

Selenium

All the selenium obtained in Australia is recovered from the anode sludge from the electrolytic refining of copper (from Mt. Lyell, Mt. Morgan, Captain's Flat and Lake George copper ores, and from imported blister) at Port Kembla. Production is small and fairly constant at about 2 tons a year. Imports are of about the same order. Demand exceeds Australian production.

Tantalum, Columbium and Niobium

Tantalite (containing up to 65 per cent. tantalum oxide) deposits exist in Western Australia and Northern Territory. Pre-war these areas contributed a large percentage of world production, but little mining has taken place in recent years. Production in 1948 amounted to 12,023 lbs. and increased to 14,996 lbs. in 1950. The largest use for tantalum (on account of its high resistance to corrosion) was formerly in the chemical industry in the production of a wide variety of equipment and machinery. It is also used for machine-tool tool-tips (tantalum carbide), radio valves, aerial-camera lenses, rayon spinnerets, infra-red photography, surgicalware, radar equipment, and as a catalyst. Columbium is an important minor component in stainless steel and special corrosion-resistant steels.

Thorium and Cerium

Thorium and cerium are usually found in association, and in Australia the mineral monazite contains about 6.6 to 6.8 per cent. of thorium and quantities of cerium and the other rare earths. The principal use of the latter metal (cerium) in Australia is in the form of "misch" metal (a ferro-cerium alloy) for the manufacture of synthetic flints for use in cigarette lighters, etc. Flints were manufactured as a war-time measure only and present requirements are imported. In 1950, 35 tons (containing about 95 per cent. of monazite) of monazite concentrate were recovered.

Tungsten

The ores of tungsten, bismuth and molybdenum are commonly found associated and have in many mines been produced more or less simultaneously (see also "Tin"). Consequently, the market fluctuations of tungsten ore have a considerable emphasis on the mining of molybdenum and bismuth. The situation (in-so-far as tungsten is concerned) has changed recently with the exploitation of the King Island scheelite deposit, which contains molybdenum as an impurity only, but which now apparently can be recovered at a profit (arrangements have been made in the United States for a new metallurgical processing). Reserves at King Island are considerable, probably the largest known deposit in the world. Australian production of tungsten concentrates in 1950 was 1,123 tons (65 per cent. concentrates). Exports (in terms of 65 per cent. concentrates) in 1950 were 1,027 tons, principally to the U.S.A., Sweden and the United Kingdom.

FOR PRECIOUS METALS

GOLD

Gold

Australia ranks fourth in world gold production, contributing about 600,000 to 1 million ozs. a year (production in 1949 amounted to 893,339 ozs. out of a world total of about 25.5 million ozs.). Of the total yield, about 10 per cent. was derived from the treatment of zinc and lead concentrates and blister copper. Production from New South Wales, Queensland and Tasmania was largely in this category. In Western Australia, 60 per cent. of the production from that State (which is nearly all deep-lead quartz mining) was from twelve large mines in and around Kalgoorlie, the balance being from a number of small mines scattered throughout the State. Victorian production was derived from a number of relatively small mines and dredges. Output from the Harrierville dredge (one of the largest dredges in the world) amounted to 7,686 ozs., and the El Dorado dredge output of 2,981 ozs. was accompanied by the recovery of 79 tons of tin concentrate.

Silver

Australia is a relatively small producer of silver, contributing on the average about 6 per cent. of the world's total. Most of the silver is obtained from lead, zinc and copper concentrates from which the silver is derived during refining. Gold and copper ores contribute about 3 per cent. of the total, the balance being derived from lead and zinc concentrates. Silver from Broken Hill lead concentrate is recovered at the Port Pirie lead refinery, part of the silver from Broken Hill zinc concentrate is finally recovered from the Risdon zinc refinery sludges at the Port Kembla copper refinery, and the remainder is recovered during treatment of the concentrate abroad. Silver in

METALS OF THE PLATINUM GROUP

Rosebery zinc concentrate, Lake George copper concentrate and Mt. Morgan, Mt. Lyell and other copper ores is finally recovered at Port Kembla. Silver in all other ores, except gold ores, is shipped abroad.

Production of silver from mines in Australia in 1950 amounted to 10,945,091 ozs. Only about two-thirds of the total silver produced is recovered as refined metal in Australia, the remainder being exported as a constituent of lead bullion and certain lead and zinc concentrates. Australian production of primary refined silver in 1950 totalled 6,883,941 fine ozs.

Metals of the Platinum Group—Platinum, Palladium, Rhodium, Osmium, Iridium and Ruthenium

All the metals—nearly always associated—of the platinum group are found in small quantities in Australia. Formerly mined in New South Wales, platinum production has ceased in recent years, and the only supply of this metal now available in Australia is obtained from the Port Kembla refinery as a by-product from the electrolytic refining of copper. This is also the only source of palladium. Platinum and palladium recovery is fairly constant at about 40 ozs. of each a year. Osmium and iridium (as a natural alloy, probably nevyanskite containing about 45 per cent. osmium, 42 per cent. iridium, 8 per cent. ruthenium, 2 per cent. platinum, 0.3 per cent. rhodium and 0.01 per cent. gold) are still obtained in a small way by fossickers from the Adamsfield district on the west coast of Tasmania. Production in 1950 amounted to 46.10 ozs., valued at £1,673. In all cases Australian production represents less than 10 per cent. of normal Australian requirements.

Smelting and Refining for Non-ferrous Metals

The following outline does not attempt to cover all the ramifications of the non-ferrous metals processing industry (see Part One), and firm capacity figures are quoted only where the activity is concentrated in the hands of large processing firms. Even here, capacity quotes assume a "normal" pattern of production. However, where varied end uses pre-

vent the concentration of processing into the hands of major firms, for instance in the processing of lead and zinc, some idea of relative importance of various usages can be gained from demand figures quoted in the text, although it should be emphasised that these do not necessarily correspond to capacity available in these fields.

SMELTING AND REFINING FOR LEAD

Australian production and exports of lead concentrates, lead and bullion, etc., and Australian sales of refined lead, in recent years were as follows—

AVAILABILITY:	1947	1948	1949	1950
	tons	tons	tons	tons
Mine production	202,919	208,426	209,291	224,840
Refined lead produced	158,548	159,497	151,753	160,526
Exports, pig lead	141,372	116,744	104,718	125,630
Exports, bullion	30,399	27,843	37,734	34,074
Exports, concentrates	19,132	18,100	10,047	7,600
Sold in Australia	33,242	34,774	40,908	41,973

It will be seen by the foregoing table that the industry is dependent on overseas markets for the sale of the major part of its production of refined lead. Furthermore, the lead price differential is considerable; for Australian consumption, £A65; for export to the United States of America, £A160; and for export to the United Kingdom, £A164 (as at 31st July, 1952). The Australian price of lead was raised to £95 per ton in September, 1952.

In 1950, by Commonwealth agreement with the major producers, it was arranged that an amount of 50,000 tons was to be allocated from

production for Australian users. At that time this was below the users' stated firm demands of about 59,000 tons. A similar allocation was agreed to for 1951. The level of demand in 1952 shows a distinct decline from the 1950 and 1951 levels. This is primarily because of financial stringency and the reduced level of building construction and public works activity. The level of apparent demand in 1952 so far suggests an annual usage figure of less than 40,000 tons. However, as users are working from stocks, demand should rise from this level. In addition, it is estimated that something of

the order of 5,000 to 10,000 tons of scrap lead (from old batteries, etc.) is recovered every year and returned to the trade in the form of antimonial lead.

The following table shows in broad figures how a total of 47,280 tons of lead was distributed in 1950 among the chief uses—

LEAD USAGE:	1950 tons
Battery plates	7,000
Alloys, bearing metals, solders	3,250
Lead pipe and sheet	9,400
Pipe caulking	1,000
Galvanising	400
Paint and white lead	9,800
Battery oxides	4,900
Chemicals	400
Cable sheathing	5,500
Collapsible tubes	1,800
Miscellaneous	3,830

ROASTING AND REFINING FOR ZINC

All the zinc concentrate for treatment in Australia ultimately finds its way to the refinery of the Electrolytic Zinc Co. of Australasia Ltd. at Risdon, Tasmania, the only zinc reduction plant in Australia. The concentrate is first flash roasted (as well as the calcines from the various acid works), leached with sulphuric acid (the sulphur for which is obtained as sulphur dioxide from the furnace gases of the flash roaster which is utilised in a nearby "contact" sulphuric-acid plant), and the resultant solution is purified by the low-density current sulphate process and then electrolysed in the cells. Although this refinery has theoretical capacity to produce 100,000 tons of zinc annually, its present effective capacity is about 85,000 tons, because of plant deterioration.

Cadmium and cobalt are separated during the process—the cadmium by electrolysis of the redissolved precipitate from zinc dust treatment—and the cobalt as a nitroso-betanaphtholate, subsequently fired to the oxide (65 per cent. cobalt oxide). Crude manganese dioxide is recovered as a sludge from the bottom of the cells. The acid referred to above is used

AVAILABILITY:	1947 tons	1948 tons	1949 tons	1950 tons
Zinc in concentrate produced	176,297	177,482	175,980	193,258
Slab zinc produced	69,421	81,312	80,956	83,652
Exports, slab zinc	28,408	33,715	33,570	44,801
Exports, concentrate	192,988	149,652	147,216	172,729
Australian consumption of slab zinc	47,442	42,018	44,024	50,150

Although refining operations have been hampered by the difficulty of securing electric power and materials, particularly structural steels for the expansion and maintenance of the works, production in 1950 (due to increased availability of water at the hydro-electric undertakings) increased to 83,652 tons, of which 54,000 tons was to be provided during 1951 for Australian consumption in accordance with the agreement between the zinc refinery interests, the Commonwealth Government and the State Prices Authorities. The price differential is still considerable; for Australian consumption it is £A65 a ton, for export to the United States of America £A150 a ton, and for export to the United Kingdom £A163 a ton (as at 31st July, 1952). The Australian price of zinc was increased to £A95 a ton in September, 1952, and the proposed allocation for the local market to 60,000 tons. The above agreement is subject to the maintenance of production at the refinery at the 1950 level. Production in the first 10 months of 1951-52 was 69,715 tons, an increase

The capacity of consuming industries, particularly battery plates, is increasing. It is also expected that with proposed new capacity for sheathing copper cables additional lead will be required.

Throughout the world as a whole, lead has progressively tended to be replaced by other metals and even as a substitute it may not regain its former importance. It is also, to date, considered to be comparatively unimportant in rearmament, although its use in civilian atomic defence may be much greater in the future than in the past. It must, however, still be considered a metal of major importance.

The existing smelter/refinery at Port Pirie, South Australia, has an effective refining capacity of about 160,000 tons of lead a year. It is planned to increase effective smelting capacity to about 200,000 tons a year by 1956-57.

partly in processing, but mostly for the production of superphosphate; small quantities of zinc sulphate are also recovered as a by-product.

An additional roasting plant and flash-roaster will increase effective capacity to about 114,000 tons a year by 1955. With the additional sulphur available from the roasters a new fertiliser plant will produce about 50,000 tons a year of ammonium sulphate. In addition to this plan to expand electrolytic refining capacity, consideration is being given to the possibility of erecting a £4 million (possibly five) refining plant at Cockle Creek in New South Wales in conjunction with existing acid and fertiliser production. This expansion programme is, however, dependent on a number of factors, not the least of which is transportation of concentrates, future price levels, and the current high cost of building and plant construction. The most suitable method of reduction from the concentrates is also subject to further examination.

The following table shows production, local usage and export of concentrates and metal—

	1947 tons	1948 tons	1949 tons	1950 tons
Zinc in concentrate produced	176,297	177,482	175,980	193,258
Slab zinc produced	69,421	81,312	80,956	83,652
Exports, slab zinc	28,408	33,715	33,570	44,801
Exports, concentrate	192,988	149,652	147,216	172,729
Australian consumption of slab zinc	47,442	42,018	44,024	50,150

of more than 2,000 tons over the corresponding period of 1950-51.

The largest users of zinc in Australia are the steel-sheet producers and some of the associates and subsidiaries of the major steel-making group. The following table shows the principal uses, during 1951, of 46,592 tons sold in Australia—

ZINC USAGE:	1950 tons
Sheet, galvanising	10,890
Pipe, galvanising	6,635
Wire, galvanising	3,716
General galvanising	3,716
Rolled strip, etc.	4,753
Foundry, etc., alloys (including copper alloys at rolling mills, etc.)	4,982
Zinc oxide	5,361
Die-casting alloys	2,718
Zinc dust	1,800
Zinc sulphate	310
Zinc chloride	2,311
Lead refining	
Batteries	
Zinc wire	
Miscellaneous	

Capacity to absorb zinc spelter, ingot, slabs, blocks, dust, etc., is steadily increasing, especially for the galvanising of steel and the making of oxides and alloys. The present consumption of the steel mills, pipe makers, wire drawers and general galvanisers is about 25,000 tons of zinc a year but by 1956 to 1960, in view of planned expansion in these industries, this figure will rise to about 50,000 tons a year. Present capacity requirements of the steel works and steel mills is about 33,000 tons a

year. Although consumption in the other industries may not expand at a similar rate, it is estimated that nearly 75 per cent. of present Australian capacity for electrolytic zinc refining will be required to maintain local manufacturing and processing capacity within five or six years. The stage may therefore be reached when the tonnage of zinc metal available for export will be reduced unless refining capacity is considerably developed.

SMELTING AND REFINING FOR COPPER

There are at present three copper smelters operating in Australia, and a fourth being built. These are operated by The Electrolytic Refining & Smelting Co. Ltd. (E.R. & S.), Port Kembla, N.S.W., by the Mount Lyell Mining & Railway Co. Ltd., Queenstown, Tas., and by Mount Morgan Limited at Mount Morgan, Qld. Mt. Isa Mines Ltd. at Mt. Isa, Queensland, has almost completed the erection of a large smelter. The copper content of the matte produced in the conventional type of blast furnaces in use varies from an average of about 38 per cent. at Queenstown to 50-55 per cent. at Port Kembla. Because of the lower copper content of the ore, percentage recovery is considerably below this figure at Mt. Morgan. Total blast furnace capacity of the three operating smelters is about 150,000 tons a year of burden and this will be increased by about 100 per cent. when the Mt. Isa smelter is completed.

of 11,000 to 12,500 tons, and one wire bar furnace with a nominal annual capacity of 30,000 tons of wire bars and cakes. Power restrictions and the high ash content of the coal is reducing capacity in each case considerably. The total effective capacity of both types of furnaces is therefore not much more than 35,000 tons a year.

The blister copper produced by Mt. Morgan goes on to E.R. & S. for refining. Mt. Lyell electrolytically refines its copper, the bulk of which goes to E.R. & S. for the production of market shapes and a part (about 2,000 tons a year) to Austral Bronze Co. Pty. Ltd., Hobart, Tas., for rolling of brasses, bronzes, etc.

Apart from the copper received by Austral Bronze, all copper produced in Australia therefore proceeds to E.R. & S. for processing into market shapes. E.R. & S. also use up to about 50 per cent. of imported blister copper in their refining operations.

The market shapes produced by E.R. & S. are supplied in the form of wire bars for wire drawing, billets for tube production, and cakes for sheet and strip moulding, and a small portion (ingots) for foundry casting alloys. (Most of the output goes to an associated company, Metal Manufactures Ltd., Port Kembla—see later.)

Both deoxidised and high-conductivity copper are produced, the former mainly in the form of billets for the production of tubes; the latter mainly in the form of wire bars, cakes (for sheet) and ingot (for copper alloy). Some arsenical (low-conductivity) copper of about 0.4 per cent. arsenic content is also made for the production of corrosion-resistant tubes. Some phosphorised copper is produced and used in the manufacture of tubing. This contains residual phosphorus and has high strength but lower conductivity.

The output of the smelters and refiners is considerably below capacity because the smelters are being affected by shortages of ores and concentrates, while the refiners are handicapped by the shortages of electric power and impurities (mainly antimony) in the metal available.

It is considered that the Australian market, under present conditions, could use up to 10,000 tons of fire-refined copper a year, although one authority suggests this could, if impurities were particularly low, be raised to about 14,000 tons a year. This would need a greater acceptance of fire-refined copper by some of the present users of electrolytic copper.

The second stage of operations is conversion of the copper matte to blister copper. The three companies at present operating have a nominal annual converter capacity of up to 30,000 tons of blister copper, while Mt. Isa Ltd. is constructing nominal converter capacity of about 25,000 tons a year, with a production level of about 18,000 tons of blister copper. However, due principally to the shortage of domestic ores and concentrates, only about 11,000 tons of blister copper were produced in Australia in 1950-51. This figure is expected to increase to about 15,000 tons in 1952.

The third major stage is the refining of blister copper (96 to 99 per cent. copper) to electrolytic copper (99.9 per cent. or better). There are two refiners of copper in Australia—Mount Lyell Mining & Railway Co. Ltd. and Electrolytic Refining & Smelting Co. Ltd. The E.R. & S. company has an anode furnace which, with pulverising plant modifications, could have an annual capacity of 40,000 tons of anodes. Mount Lyell produces considerable tonnages of good-quality blister copper (97 per cent. or better) which is cast direct from the converters, for electrolytic refining, without the use of an anode furnace. Mount Lyell has an electrolytic refining capacity of 13,000 tons annually, and E.R. & S. of 20,500 tons annually. Electrolytic tankhouse and smelting capacity at E.R. & S. is to be increased to permit refining of an additional 18,000 tons of blister a year by 1954-55. The blister will come from Mt. Isa Ltd., which expects to produce this amount by 1954-55. This will increase the combined electrolytic refining and smelting capacity at E.R. & S. to 36,000 tons a year.

E.R. & S. have four electric furnaces for casting billets with a nominal annual capacity

REDUCTION AND REFINING FOR ALUMINIUM

To date no aluminium ingot has been produced in Australia and all requirements for local processing have been imported. In 1944, however, an agreement between the Common-

wealth and the State Government of Tasmania provided for the joint establishment in Tasmania of plant for production of aluminium. The Australian Aluminium Production Commis-

sion was constituted in May, 1945, to give effect to this agreement. The Bayer process will be used for extraction of high-grade alumina from bauxite, and the Hall-Herault method of electrolysis.

Erection of the plant, at Bell Bay, Tasmania, is now under way, and is expected to be completed in 1954. Full production is not likely to be attained until 1955 because of power shortages. This plant is expected to produce about 13,000 tons of aluminium ingot a year, which will require between 75,000 and 80,000 tons of high-grade bauxite. The bauxite will initially be imported, but it is proposed to make a gradual change over to Australian bauxite as soon as technical and economic conditions permit. Any increase in capacity of this plant would be governed by availability of hydro-electric power.

Total annual consumption in Australia of aluminium metal (in all forms) is between

12,000 and 14,000 tons. In 1949, actual consumption was: Ingots, 7,191 tons; semi-fabricated, 3,801 tons; secondary metal, 3,500 tons; a total of 14,492 tons. Consumption is expected to increase at a rate of about 2,000 tons a year, and it is estimated that by 1955 consumption will be of the order of 20,000 tons a year. Aluminium is sold in Australia at world prices, which in July 1952 were: United Kingdom £A196; U.S.A. £A190. Imports of aluminium ingot in 1949-50 were 6,563 tons and in 1950-51, 8,568 tons.

It should be borne in mind that the establishment of the aluminium industry would make practicable the manufacture of fused alumina, all of which at present is imported (for refractory use, see Chapter 2, "Non-metallic Minerals").

Should Australian consumption of aluminium increase in line with world consumption, it may be necessary to consider in the near future the duplication of refining plant now being erected at Bell Bay.

SMELTING FOR TIN, AND DE-TINNING

All tin concentrate is smelted in Australia by O. T. Lempriere & Co. Pty. Ltd. and The British Metal Corporation (Australia) Pty. Ltd., both in Sydney, N.S.W. The combined capacity of these two smelters amounts to about 6,000 tons of tin a year. Production, however, has been far below capacity, because of the continued low Australian production of tin concentrates. In recent years, output of the tin smelters has been—

PRODUCTION:	tons
1947	2,377
1948	1,884
1949	1,955
1950	2,013

De-tinning operations are carried out by Electro-Chemical Metal Refining Co. Pty. Ltd., also of Sydney. De-tinning capacity in Australia will be doubled when the parent company, Albert G. Sims Ltd., of the above company, begins the activity in about a year's time at one of its establishments at Melbourne, Vic. (See "Collection and Remelting of Base Non-Ferrous Metal and Scrap, including De-tinning, later this Part.)

Because domestic consumption of tin is in excess of local production, the export of tin

and tin concentrate from Australia is normally prohibited. However, small parcels of slag, drosses, and mixed concentrates, difficult to treat in Australia, are exported under licence from time to time. Imports of tin in 1948 were 395 tons; in 1949, 270 tons; and in 1950, 249 tons.

Australian requirements of tin are normally estimated at between 2,400 and 2,800 tons a year. It is estimated that consumption is distributed among various uses as follows—

CONSUMPTION:	
Solder	40%
Bearing and other alloys	25%
Tinning	20%
Miscellaneous	15%

Until the proposed tinplate works at Port Kembla commences operations (some time between 1956 and 1960) there is unlikely to be any appreciable alteration of these percentages. This industry, however, would then increase Australia's primary tin requirements to some 5,000 to 5,500 tons a year. Tin prices in July 1952 were: Australia £A1,150 per ton; United Kingdom £A1,208; U.S.A. £A1,215.

ALLOYING OF BASE NON-FERROUS METALS

The manufacture of non-ferrous alloys, particularly for type and stereo metals and bearing alloys, is a substantial activity of several firms. There is plenty of capacity to meet the re-

quirements of users of these alloys, and for diecasting brasses and zinc-based alloys. Most foundries requiring non-ferrous alloys buy their requirements from remelters.

REFINING FOR MINOR METALS

Only three of the minor metals mined in Australia (see earlier) are refined locally; a number of others are exported as ores for refining overseas.

The output of refined ANTIMONY by the one Australian refinery in 1950 was 495 tons. In addition, The Broken Hill Associated Smelters produced, as a by-product of lead smelting at Port Pirie, 2,795 tons of antimonial lead, containing 288 tons of antimony. The principal uses of antimony are as an antimonial-lead alloy in the manufacture of storage batteries, anti-friction alloys, cable sheathing, type metal and pewter; as a pigment in paints, enamels and pottery; and as a chemical in flame proofing compounds and safety matches. Imports of antimony and antimonial-lead compounds in recent years were—

IMPORTS:	1949-50 cwt.	1950-51 cwt.
Antimony and antimonial and lead compounds		
Antimony	2,740	5,375
Anti-friction and plastic metals . . .	97	202
Brazing and soldering alloys in any form	2,463	2,465

BISMUTH METAL is recovered from mixed concentrates by two companies which also treat imported ore. One other company prepares bismuth salts from metal specially prepared by a subsidiary company. In 1950, Australian production of bismuth concentrate in terms of metal content was 18 cwt. Imports of bismuth metal in 1949-50 were 5,016 lbs., and in 1950-51, 19,075 lbs. About 95 per cent. of the bismuth used in Australia is in the form

of salts for medicinal preparations, the remainder being used in fusible alloys. Imports of bismuth carbonate were 4,100 lbs. in 1949-50 and of other bismuth salts and bismuthates, 4,276 lbs.

The Broken Hill Proprietary Co. Ltd. makes tungsten powder from WOLFRAMITE (via tungstic acid), for use in the manufacture of tungsten-carbide die-nibs and tool-tips. Some

tungsten powder is also made for sale. The capacity of this plant is about 750 lbs. of tungsten powder (metal) a day. Ferro-tungsten was made by The Broken Hill Pty. Co. Ltd. as a war-time measure, but this production has now ceased. Tungsten wire-rod and wire were also made during the war. Tungsten contacts have been made in Australia for many years.

COLLECTION AND REMELTING OF BASE NON-FERROUS METAL AND SCRAP, INCLUDING DETINNING OF TINPLATE

Prior to the 1939-45 War collection of base non-ferrous metal scrap, for subsequent recovery and remelting, was limited for economic reasons to those forms of scrap metal which provided the greatest return for the efforts involved for supply to the few industries then capable of absorbing it. The most important scrap materials then were good copper scrap, scrap brass and gunmetal castings and fittings, aluminium sheet cuttings and scrap alloy castings, battery lead, and small quantities of zinc drosses.

During and since the war practically every form of non-ferrous scrap known has been collected, either for subsequent remelting and alloying for local use or for export. Attractive overseas prices for war disposal materials of local and overseas origin (including "Lend-Lease") swelled the number of collectors in the field and the tonnages bought from collectors by well-organised remelting organisations considerably increased.

These remelting organisations now have capacity to segregate, remelt and re-alloy about 50,000 tons of secondary or scrap BRASSES, BRONZES and ALUMINIUM ALLOYS a year. Most of these remelters often recover quite good quantities of fairly high-purity COPPER, ALUMINIUM, ZINC, LEAD and TIN. None of these have the facilities, however, for recovery of nickel, silicon, manganese, or for any of the other special alloying elements such as chromium, cobalt, titanium. Nevertheless, the laboratory and melting facilities of the remelters is fairly good and frequently standard specification alloys of copper and aluminium are produced from virgin and secondary materials.

The tendency now is for most of the non-ferrous metal foundries in Australia to obtain the bulk of their casting alloys from the remelters.

Some of the larger users of secondary metal, especially the extruders of rods and sections, are also considerably engaged as dealers to secure all or much of their own requirements. These extruders in the copper-alloy group have a capacity of over 15,000 tons a year, most of which is used in the making of brass screws, window sections, bolts, rivets, etc.

Each State has legislation which requires buyers and sellers of scrap metals to be licensed. A few of these dealers have small oil-fired crucible furnaces in which they melt non-ferrous scrap for ingotting in convenient shapes for handling and transport.

As a consequence of the large quantities of surplus war materials available, from complete aircraft to large tonnages of brass shellcases, established remelters and collectors have widened their fields of activity to New Guinea and several Pacific Islands, and many new-

comers have entered the field, mainly in collecting.

Specification alloyers of printers' metals—linotype, monotype and stereotype—collect drosses and discarded "case" type, stereotypes and electrotypes, from printers and trade compositors. The big suppliers of such lead-alloy wastes usually have them treated on fee and the metal returned; with smaller suppliers the wastes are either sold outright or exchanged with ingot metal in a quantity allowing for treatment and handling charged. It is becoming an increasing practice for printers and trade compositors not to remelt circulatory metal at their establishments (the usual practice), but to have it regularly taken away, remelted, brought to specification and returned in ingot to the printer, on fee.

The collection of discarded bearings from garages, etc., is done mainly by small dealers, and the metal recovered by the remelters for various ends, including secondary BEARING-METAL. The principal manufacturers of specification bearing metals, however, use virgin metals only (see "Alloying", earlier this Part).

DETINNING OF SCRAP TINPLATE is carried on only at one establishment in Australia, at Sydney, N.S.W. The same organisation is preparing to double its capacity by erection of a factory at Melbourne, to take advantage of scrap available there. The new factory is expected to be in operation within two years, and will use the Metal and Thermite Corporation process, on licence. In 1949-50 about 5,040 tons of scrap tinplate were processed to recover about 740 cwt. of tin. The recovered steel (about 5,000 tons) is hydraulically pressed into cubes and sent to the steel works. Exports of scrap tinplate originating as scrap in Australia were 8,370 tons (£61,072) in 1949-50 and 10,735 tons (£129,429) in 1950-51; practically all the scrap was sent to the U.S.A.

(For recovery of precious metals from jewellers' wastes, sweepings, etc., and refining residues, see the next section, "Refining of Precious Metals", this Part.)

Published statistics of production of secondary non-ferrous base metals are incomplete and are not included here because of that fact.

Exports of base non-ferrous scrap metal in the immediate post-war years were considerably greater than pre-war, but with the resumption of Government control on the export of the more important types in short supply—copper, zinc, aluminium, tin, and lead—the amounts exported recently were comparatively small. Exports of scrap of Australian origin in 1949-50 and 1950-51 were as follows—

EXPORTS:	1949-50		1950-51	
	tons	£	tons	£
Copper scrap	(a)	(a)	(a)	(a)
Scrap copper-base alloys (except brazing and soldering alloys)	22	1,195	15	1,702
Scrap tin	271 (b)	1,108	—	—
Scrap and shavings of zinc and spelter	16	384	95	6,395
Lead scrap	136	5,539	3	366
Totals	445	8,226	113	8,463

(a) Copper scrap originating from the British Solomons was exported from Australia in each of these years. The export of copper scrap of Australian origin is prohibited.

(b) It is likely that this comprises scrap tinplate.

Imports of scrap have increased considerably in recent years and for 1949-50 and 1950-51 were as follows—

IMPORTS:	1949-50		1950-51	
	tons	£	tons	£
Scrap aluminium and aluminium base alloys	—	31	42	3,896
Copper scrap	158	9,464	57	5,141
Scrap copper-base alloys (excepting brazing and soldering alloys)	98	5,187	59	7,518
Nickel scrap	15	4,217	11	4,968
Nickel-base alloys scrap	—	1	2	423
Tin scrap	3	2,322	93	47,684
Tin-based alloy scrap	4	3,473	—	—
Scraps and shavings of zinc and spelter	—	5	—	5
Lead scraps	15	72	10	544
Scrap of other base non-ferrous metals	172	7,276	128	3,189
Totals	465	£32,048	402	£73,368

REFINING FOR PRECIOUS METALS

Newly-won Gold

In Australia gold only among the precious metals is directly refined. Capacity to do so is well in excess of the demand being made upon it, which comprises all the gold in unrefined gold bullion won in Australia, New Guinea and Papua, New Zealand, and, since late 1951, practically all of the Fijian production as well. (New Zealand and Fiji have no refining capacity.)

About 90 per cent. of the gold won in Australia comes from the gold industry proper, the remainder from refining for copper, lead and zinc.

The availability of gold bullion for direct gold refining (that is, not including gold in base-metal bullion) in Australia in 1950 was as follows—

AVAILABILITY OF GOLD BULLION:		1950
		fine oz. content
Australian production (approximately)		768,600
Imports—		
New Guinea and Papua		117,242
New Zealand		41,355
Fiji		247
Other countries		47
Total (approximately)		927,491

Base-metal refineries in 1950 produced, in addition, about 100,000 ozs. of fine gold (that is, not bullion).

The whole of the bullion production of the Loloma, Emperor and Dolphin mines of the Vatukoulu field in Fiji has been refined in Australia since about late November, 1951, the total supply from those mines until early May, 1952, being about 50,170 fine ozs content.

There are no published statistics of refined gold produced by the whole of the gold-refining capacity in Australia for either the calendar year or the financial year. About 80 per cent. of the gold-refining capacity, excluding that at base-metal refineries, is at the two branches of the Royal Mint, mainly the Perth branch. The remaining 20 per cent. is mainly that of Garrett, Davidson & Matthey Pty. Ltd., Sydney, N.S.W.

Exports of gold of Australian origin in recent years have been as follows (statistics source shows value only)—

EXPORTS:	1947-48	1948-49	1949-50
	£	£	£
Refined gold in ingot, bar, sheet, granulated, dust, etc.	3,830,938	4,281	1,301
Gold content of ores and concentrates, exported	141,501	60,187	123,935
Totals	3,972,439	64,468	125,236

The large quantity exported in 1947-48 went to the United Kingdom. The Fijian gold now being refined in Australia is all exported, that being a condition under which a permit was granted by the Commonwealth Bank for the gold bullion to enter into and be refined in Australia.

Newly-won Silver

About two-thirds of the silver mined in Australia is recovered (in fine) as the result of refining for lead, zinc, copper and gold—by far the greater portion being secured from refining of silver-bearing lead concentrate at the Port Pirie lead smelter/refinery. The other one-third is exported in base-metal bullion and concentrates, particularly silver-lead bullion, of which 743,899 cwt. (£5,377,275) and 670,944 cwt. (£4,395,536) were exported in 1948-49 and 1949-50, practically all from the Mt. Isa mine, Queensland.

The total availability of silver from mines in Australia and imported from mines abroad, in 1950, was as follows—

AVAILABILITY:		1950
		fine oz. content
Australian origin—		
Silver in concentrate (a)		8,001,742
Silver in silver-lead bullion (b)		2,478,655
Silver in gold bullion		197,059
Imports—		
New Zealand		14,770
New Guinea and Papua		51,130
Fiji		8,580
Total		10,751,936

(a) Mostly recovered in Australia.
(b) Entirely recovered overseas.

The output of refined silver in recent years in Australia was as follows—

PRODUCTION:	1948	1949	1950
	fine ozs.	fine ozs.	fine ozs.
Base-metal refineries (a)	6,212,033	5,573,305	6,658,685
Royal Mint branches (b)	201,409	205,362	187,243
Totals (c)	6,465,616	5,857,502	6,883,941

(a) The production at the Port Pirie lead smelter/refinery in 1950 was 6,883,941 fine ozs.

(b) From gold bullion of Australian origin.

(c) Includes small amounts of silver in gold bullion from Papua and New Guinea.

Exports of silver of Australian origin in recent years have been (approximately) as follows—

EXPORTS:	1948	1949	1950
	fine ozs.	fine ozs.	fine ozs.
Refined silver in ingot, bar, sheet, granulated, dust, etc.	5,385,887	4,555,738	7,488,141
Silver content of ores and concentrates exported (approx.)	1,395,000	1,575,200	1,343,000
Silver content of Mt. Isa silver-lead bullion	2,235,562	2,485,473	2,478,655
Totals (approx.)	9,016,449	8,616,411	11,309,796

Other Precious Metals

PLATINUM and PALLADIUM are secured in Australia from indigenous sources only as a by-product of electrolytic refining of copper and zinc. Although the annual recovery—about 40 ozs. of each of the two metals—is very small it comprises all the recovery that is feasible in Australia.

No other precious metals are refined in Australia.

Recovery from Wrought Gold Jewellers' Wastes, etc.

The established capacity in Australia to recover precious metals of all kinds from wrought gold, lemls, sweepings, liquids, refining residues, appears to be adequate to the demand. The capacity to recover from jewellers' wastes, in particular, was expanded in the post-war period. No statistics of quantity and value of metals recovered are published.

Dental Golds and Alloys

The Australian commercial production of dental alloys is almost entirely from the three main metallurgists and fabricators of precious metals, one in particular having made itself

prominent in the manufacture of casting and inlay golds, dental alloys, copper amalgam, lingual and palatal bars, solders, wires, tinfoil, platinum foil, waxes, impression compounds, pastes, etc. (and also supplies dental cements made in Australia by another company).

Statistics of materials used and production of items of dental supplies are not collected. Exports are not shown separately, but it is reported that a fair export trade in most of the items made in Australia has been developed. Imports of dental alloys and amalgams in 1948-49, 1949-50 and 1950-51 were valued at £8,578, £16,087 and £10,869, mainly from the United Kingdom and the U.S.A. (Imports of dental cements, impression and denture materials, etc., for the same periods were valued at £45,727, £35,534 and £58,846.)

A branch of a U.K. company which has world-wide interests in supply of dentists' requirements has an Australian subsidiary company engaged in supply, the company being a principal manufacturer in Australia of impression and denture materials. The policy of the company is to extend the manufacture of dental supplies in Australia; it is about to enter into manufacture of dental alloys.

Finished Shapes of Non-ferrous Metals (including Precious Metals)

The total effective capacity in Australia for rolling, drawing and extruding non-ferrous metals and alloys is in the vicinity of 110,000 tons a year, of which some 80,000 tons are available for the copper and copper-base alloy group. The balance of capacity is available for the processing of aluminium, lead, zinc, and, to a minor extent, other metals.

Current production is well below capacity owing to the world shortage of the principal base metals and to local deficiencies in electric power and the quality of recent fuel supplies. There is a large import of non-ferrous finished shapes, particularly of copper and aluminium; these are now under licence (see Appendix II). There is a small export to near countries, but exports are closely controlled.

COPPER AND COPPER ALLOY

As an introduction to the detail of capacity in Australia to meet the demand for mill products of copper and copper-base alloys, an overall statement of statistics of availability—production, imports, exports—is provided.

The following table shows estimates of Australian capacity to produce major categories of

copper and copper-alloy shapes, wires and cables, castings and chemicals (copper sulphate, mainly), in 1950 and 1952-53 and the estimated amount of copper required to operate at full capacity. It gives output of these products in 1950 and the quantities of copper used to make them.

PRODUCTION CAPACITY:	1950-51		1952-53	
	Production	Copper Used	Capacity	Copper Required for Operations at Full Capacity
Copper and copper-alloy wires and cables (a) ...	tons	tons	tons	tons
Copper and copper-alloy tubes ...	20,500	20,500	48,000	48,000
Copper and copper-alloy sheets and strips (excluding Government factories) ...	6,000	5,000	8,000	10,000
Copper and copper-alloy rods and sections ...	10,500	7,700	16,800	14,500
Brass and bronze castings (b) ...	13,000	10,000	18,000	13,500
Chemicals and miscellaneous ...	21,000	18,500	40,000	25,000
Totals ...	1,000	1,000	1,500	1,500
	71,000	62,700 (c)	132,300	112,500 (d)

(a) Metal Manufactures Ltd. have capacity to produce annually about 35,000 tons of wire, although in practice a substantial part of this capacity is used to produce drawing wire for its associate wire-drawing companies and other processors. Part of M.M. Ltd. capacity is also used to draw aluminium wire for its own use in manufacture of aluminium steel-cored stranded conductor.

(b) It is doubtful whether the demand for most copper products, with the exception of wires and cables, is in excess of the capacity of the industry to produce. Certainly in the foundry industry the capacity of the foundries is much in excess of the demand for castings.

(c) In the production of copper and copper-alloy sheets, strips, rods, sections and castings, and to a lesser extent tubes and wires, about 21,000 tons of secondary copper were absorbed. Thus about 41,000 tons of new copper were used to produce about 71,000 tons of products. The difference between copper used and products produced, represents the amount (approximately) of zinc, nickel, aluminium, tin, etc., employed in the manufacture of rolled, extruded and cast alloys.

(d) About 40,000 tons of secondary copper is included in this estimate. Thus, an amount of about 77,000 tons of new copper would be required to operate the industry at full capacity.

The following table of imports shows the amounts of copper and copper-base alloys (and approximate copper content thereof) that entered Australia during the three years 1948-

49, 1949-50 and 1950-51, as scrap, pig, intermediate and finished shapes (including plain wire), strands and stranded cable, covered wires and cables, and certain other products—

IMPORTS (approximate):	1948-49	1949-50	1950-51	Copper Content Only (approximate estimation)		
				1948-49	1949-50	1950-51
Copper—	tons	tons	tons	tons	tons	tons
Scrap	87	158	57			
Pigs, ingots, blocks and other refinery shapes (includes wire-bars)	13,576	16,368	20,602			
Rods, bars	114	6,865	13,339			
Angles, channels, tees	3	56	—			
Plates, sheets and strips (including process-engravers' copper plate)	1,281	822	1,340	18,226	32,348	39,681
Pipes and tubes	75	111	138			
Wires	2,146	5,015	2,185			
Wires, stranded or twisted and metal cordage of copper	941	2,951	2,018			
Washers and rivets (a)	3	2	2			
Totals, all-copper products	18,226	32,348	39,681			
Copper-base Alloys (except Brazing and Soldering Alloys)—						
Scrap	57	98	59			
Pigs, ingots, blocks and other refinery shapes—						
Brass (except yellow group)	1	11	5			
Bronze and gunmetal, mainly copper-tin-zinc and copper-tin alloys	170	391	50			
Other copper-base alloys	169	76	7			
Rod and bar—						
Brass	9	6	25			
Other copper-base alloys	11	7	20			
Angles, channels, tees—						
Brass	—	—	—			
Other copper-base alloys	—	—	—			
Plates, sheets, strips—				789	1,978	1,263
Brass	152	262	147			
Other copper-base alloys	39	10	34			
Pipes and tubes—						
Brass	15	34	30			
Other copper-base alloys	1	13	7			
Wire—						
Brass	209	312	338			
Other copper-base alloys	72	2,293	694			
Woven wire—						
Paper-machine wires (bronze)	32	47	30			
Over 120 holes to lineal inch (b)	4	90	28			
120 holes or less to lineal inch, wholly of brass, bronze or gunmetal	111	91	208			
Totals, copper-base alloy products	1,052	2,640	1,682			
Power and Communication Wires and Cables—						
Lead-covered cables and wires	10,492	15,867	12,927			
Covered cables, wires and strip (including enamelled wires), not lead-covered	4,349	5,838	4,416	6,537	9,221	7,206
Totals, covered wires and cables	14,841	21,705	17,343			
Totals of copper content (approximate estimation)				25,552	43,547	48,150

(a) Does not include bifurcated rivets, the imports of which, in coppered steel, copper and brass, are grouped into one item. Copper nails are imported in small quantity, but are not separately stated in imports statistics.

(b) Includes woven wire of various metals, including ferrous, such as stainless steel. However, according to trade report the wire "cloth", gauze, etc., greater than 120-mesh imported into Australia is usually practically all non-ferrous, mainly bronze, some brass, and a little copper.

Exports of copper, including the copper content of certain products, have been negligible in recent years. Export is controlled and subjected to approval only in special circumstances.

Copper Supply

The greatest bulk of virgin copper is used in Australia by wiredrawing and cablemaking plants for the production of copper conductors, wires and cables for power-supply lines and industrial and domestic installations. Of the remainder, the largest consumption is by the rolling and extrusion mills for sheet, strip, tube, rod, sections, etc.; these products are then used by a very wide range of industry. Industry generally uses some virgin copper for foundry casting, alloying and other purposes, but principally relies on secondary material for requirements.

On the basis of primary copper content, Australia required in 1951 about 75,000 tons in all forms (68,000 to 70,000 tons of which could have been fabricated into wires, cables, sheets, strips, rods, sections, tubes and castings, etc., in Australia). This is about double the pre-war demand. Demand has since fallen, and in 1952 about 60,000 to 65,000 tons would meet requirements.

In 1950-51, about 11,000 tons of copper were produced in Australia from domestic ores and concentrates, and about 32,000 tons of intermediate shapes (i.e., wire bars, ingots, rods, drawing wire, etc.) and finished shapes were imported. About 41,000 tons of finished shapes (i.e., wires, sheet, piped, etc.) were produced. In addition, about 15,000 tons of finished shapes of copper were imported in the same year.

Production in Australia during 1950-51 was broadly as follows (in terms of primary copper)—

PRODUCTION:	1950-51
	tons
Castings	4,800
Wires	20,400
Tubes	6,000
Sheets and strips	9,200
Miscellaneous (including sulphate)	1,000
Total	41,400

A survey made by the Division of Industrial Development indicated that 25,000 tons of secondary copper (reclaimed from copper and copper-alloy scrap) was used in Australia in 1950, mainly in foundries. It is thought that current usage would be about 20,000 tons, although some opinions accept a figure considerably below this.

The principal forms in which copper was required in 1951 are as follows—

REQUIREMENTS:	1951
	tons
Castings (a)	6,000
Wires and cables (b)	40,000
Tubes	8,000
Sheets and strips	13,000
Rods and sections (a)	5,500
Miscellaneous (including sulphates)	1,500
Total	74,000

(a) Should the supply of secondary copper fall below current levels, demand for virgin copper for these purposes would rise.

(b) This is particularly affected by programmes for the generation and transmission of electricity.

Exports of copper in all forms (except matte and speiss) would be little more than 600 tons in 1951, most of which is returned after refining overseas. Australian copper sells in Australia at £A285 a ton, as against the London price of £A359 a ton and the New York price of £A360 to £A365 a ton (July, 1952). The Australian price of copper was increased to £A350 a ton in September, 1952.

It is evident that pending a sufficient increase in local copper production Australia must continue to import a considerable portion of its copper requirements. This will have to be further supplemented by importation of intermediate and finished shapes (see below). Present production of copper from domestic ores and concentrates should amount to 15,000 tons as against an estimated demand, in terms of new copper, of 60,000 to 65,000 tons a year. By early 1953, it is expected that Australian production of copper from indigenous ores will increase by about 18,000 tons a year as the new mill and smelter at Mt. Isa comes into full operation. This should make the level of copper production from local ores in Australia about 33,000 tons a year in 1953.

Wire

Metal Manufactures Ltd. is the only organisation in Australia which has rolling-mill equipment for the rolling of wire-rod from wire bars. It makes and also imports wire-bars. The company makes rod and wire both for further processing in its own factories and for supply to other cable manufacturers who subsequently redraw, strand and cover it for various purposes. The main products of Metal Manufactures Ltd. are bare copper wire and strand, cadmium-copper wire and strand, trolley-wire, copper rod, brass wire and rod, aluminium wire (for next product), aluminium steel-cored stranded conductor, copper and copper-alloy tubes, aerial cables and textile and glass-covered wires. Metal Manufactures Ltd. has capacity to produce about 35,000 tons of wire annually. This will be increased to between 45,000 and 50,000 tons a year by 1954. The plant at present is operating at about 75-80 per cent. of capacity.

The following was, in 1951, the approximate distribution, by uses, of the output of Metal Manufactures Ltd.—

Building and construction	11.9%
Transportation (railways and shipping)	4.1%
Household supplies	4.4%
Electrical industry	74.6%
Food, farming and chemical industries	2.5%
Miscellaneous	2.5%
Completing	100.0%

There are other manufacturers, particularly in the manufacture of wires and cables for power transmission and communications, (see "Wires and Cables", Chapter 11, for details)

with capacity to draw copper and copper-alloy wire, but only from the re-drawing wire stage. The annual capacity of these re-drawers is estimated to be about 14,000 tons. This will be increased to about 19,000 tons a year, including p.i.l.c., by the end of 1953. Re-drawing wire is obtained in Australia and from overseas.

Tube

Metal Manufactures Ltd., the only manufacturer in Australia of copper and copper-alloy tube, has existing capacity for the production of 7,500 tons a year of copper and copper-alloy tubing—water reticulation, 3,000 tons; refrigeration, heating and ventilation, 950 tons; condenser and boiler tubing, 750 tons; sugar, agricultural and dairying industries, 750 tons; power generation, 500 tons; and shipping, automotive and tractor industries, 300 tons; and others, 1,250 tons. Additions to capacity at present being installed are designed to raise capacity for the production of tube to 10,000 tons a year. Current level of output is about 6,000 tons of tubing a year.

Sheet, Strip, Bars, Sections

Requirements in 1952 of virgin copper, for the production of sheet and strip of copper, brass, phosphor bronze, gilding metal, nickel silver, etc., extruded rod of copper, and extruded rods, sections and wire of copper alloy at the three mills of Austral Bronze Co. Pty. Ltd. is estimated at about 5,500 tons for sheet and strip and 3,000 tons for rods and sections a year. To operate at full capacity, about 7,750 tons of copper for sheet and strip and about 3,800 tons for rods, sections and brass wire would be required. Austral Bronze's capacity for rolling sheet products will be doubled in the next few years. The bulk of the rod and section produced is extruded, however, from secondary metal. Copper for the strip mill owned by Austral Bronze Co. Pty. Ltd. at Derwent Park, Tasmania, is usually supplied direct from the electrolytic refinery of the Mt. Lyell Mining & Railway Co. Ltd.

G. E. Crane & Sons Ltd. produce copper sheet and circles. The company's capacity is considerably below that of Austral Bronze Co. Pty. Ltd.

Main consumers of the products of Austral Bronze Co. Pty. Ltd. and G. E. Crane & Sons Ltd. are the transport-equipment industry, electrical-equipment industry, housing (hot-water units), food-processing and general-engineering industries.

The Commonwealth Government Ammunition Factories have considerable capacity to roll copper and copper-alloy sheet and strip, and have supplied copper-alloy sheet and strip for commercial use over various periods.

Process-engravers' copper plate (for letterpress printing, mainly of multicolour half-tone illustrations) and sheets for gravure printing are rolled copper products not made in Australia. Gravure sheets are in small demand, as there are only two users. Cleared imports of "plates for engravers, lithographers, other than prepared zinc plates" (which would comprise copper plates only, and practically all process-engravers' plate—see also "Zinc", later this Part) for 1949-50 and 1950-51 were 35 tons, valued at £24,348, and 62 tons, £38,048. (Process-engravers' zinc plates are made in Australia.)

In addition to the major processors of copper and copper alloys, there are two extruders in Victoria of brass and bronze rods, sections, bars,

etc.,—Extruded Metals Pty. Ltd. and Metalex Pty. Ltd.—which together have a capacity of about 2,500 tons of extruded products a year. One of these companies is at present installing new extruders which will bring that capacity up to about 4,500 tons. To operate the extruders of the two companies to capacity, about 1,500 tons of virgin copper is required in addition to the tonnage of secondary copper and brass normally used. There is also a small extrusion plant in South Australia, operated by Pope Products Ltd. for its own requirements in manufacture of garden sprays, hose fittings,

handtools, washing machines and other domestic products.

Foundry Copper Alloys

Brass and bronze foundries have capacity to produce about 50,000 tons of copper and copper-alloy castings a year. About 4,000 tons of virgin copper ingot and about 20,000 tons of secondary copper have been used annually; total 24,000 tons. (There is conflicting opinion on the usage of secondary copper for castings, and a figure of about 12,000 tons has been suggested by one authority—see earlier.) The scrap dealers/remelters supply the bulk of the foundry industry's requirements of ingot.

LEAD

The greater part of manufacture of rolled and extruded lead products, particularly for building and plumbing requirements, is established at Melbourne and Sydney. Apparently there is capacity to spare for the needs of those two capital cities and their States. There are makers of lead shapes at other capital cities, but those States are dependent upon the Sydney or Melbourne mills for a sizable portion of requirements.

Published statistics of production of lead products are limited, and are as follows for 1948-49 and 1949-50—

PRODUCTION:	1948-49		1949-50	
	tons	£	tons	£
Lead pipes and tubes	2,176	116,348	2,249	153,781
Lead sheets	6,325	327,296	8,373	507,531

Exports of finished shapes of lead of Australian origin in 1949-50 and 1950-51 were—

EXPORTS:	1949-50		1950-51	
	tons	£	tons	£
Sheet and piping . . .	440	57,410	335	64,961
Other shapes, except leaf and foil	102	11,654	3	690
Totals	542	£69,064	338	£65,651

The exports were mainly to the Middle East, Far East, New Zealand and Pacific Islands.

Imports of finished shapes of lead have been insignificant.

There is only one producer of LEAD SHOT in Australia, at one establishment. The annual output of shot is not published. Imports of "shots, bullets and slugs" were, in 1948-49 and 1949-50, 23 tons, valued at £2,671, and 33 tons, £6,713. Exports were 30 cwt., £457, and 9 cwt., £144, for the same years. The Commonwealth Government Ammunition factories make their own requirements of lead-cores for jacketed bullets, and shrapnel, and the only manufacturer of small-calibre cartridges makes its own unjacketed bullets.

ALUMINIUM

Capacity for the fabrication of finished shapes of aluminium is being substantially increased, and by 1953-54 will be more than adequate to process the output of the Bell Bay refinery (13,000 tons a year). Products made include sheet, strip, rod, wire, tube, sections, etc. Present capacity, however, is not sufficient to meet Australian requirements, and substantial quantities are imported. Recent imports were—

IMPORTS:	1949-50		1950-51	
	cwt.		cwt.	
Aluminium and aluminium-base alloys—				
Rods, bars	395		5,280	
Angles, channels, tees	406		1,421	
Plates, sheets, strips—	42,158			
Corrugated	9,773 (a)		23,012	
Other than corrugated	9,361 (a)		40,729	
Pipes and tubes	1,791		3,438	

(a) Last three months only, previously included under "Plates, sheets, strips".

Capacity for aluminium steel-cored cable at Metal Manufactures Ltd., the only manufacturer, is at present about 5,000 tons a year, and is to be increased to 10,000 tons a year by 1953.

In addition to this fabricating capacity, the light aluminium-alloy industry is estimated to have an annual capacity of up to 10,000 tons of castings. Many foundries, however, have capacity to produce copper and copper-alloy castings (and in some cases ferrous castings) as well as aluminium alloy, and in many instances such capacity is not all complementary.

The two fabricators of aluminium finished shapes are each installing foil-rolling mills to meet Australian demand, which is at present about 1,100 tons a year. Very fine thicknesses of foil (down to .00035 in.) suitable for light wrap-

pings will be rolled, but imports, in view of the price and wide range and variety offered in this thickness, may continue for some years.

The use of aluminium and aluminium products in Australia is expected to be in line with the increase overseas. World production and usage of aluminium increased in 1950 to about 1,300,000 metric tons, from about 600,000 tons in 1935. The continuing shortages of other metals, including steel, the trend toward weight reduction in power units and other machinery, etc., suggests that it may be necessary to consider in the near future the duplication of refining plant now being erected, and consequent increase in fabricating capacity.

IMPACT EXTRUSION of aluminium, particularly for condenser cans, coil cans, valve

shields, etc., required by the electronics-equipment industry is carried on in Australia. There are no published statistics of production, or of imports and exports of products. Imports are understood to have been sizable until about three years ago, but establishment of impact-extrusion capacity by three manufacturers, including a leading radio and electronics-equipment manufacturer, and also the deep-drawing of cans provided an Australian supply that cut back the imports. A company making dry-cell batteries and impact-extruding its cans, is about to enter into impact extrusion of aluminium as well; the company is associated with one of the leading manufacturers in Australia of radios and other electronic equipment.

ZINC

The manufacturers in Australia of finished shapes of zinc appear to have adequate capacity to meet Australian requirements other than for sheet (that is, above 20 inches wide), which is not made in Australia. There are no published

statistics of production. Exports have been sizable. Imports are small in quantity, but significant in that a sizable portion comprises wide sheet, which is not made in Australia.

EXPORTS:

	1948-49		1949-50		1950-51	
	tons	£	tons	£	tons	£
Plates and sheets (a)	316	40,388	1,234	138,635	103	32,500
Circles, segments, strip, etc.	501	73,845	944	142,922	2,394	532,654
Circles and ingots, bored or unbored for cyanide gold process; blocks for marine boilers	(b)	(b)	3	431	—	28
Totals	817	£114,233	2,181	£281,988	2,497	£565,182

(a) This would be mainly plates.

(b) Not recorded separately.

TOTAL IMPORTS:

	1948-49		1949-50		1950-51	
	tons	£	tons	£	tons	£
Plates and sheets (including prepared for process engravers and lithographers) (a)	136	35,068	114	38,121	120	54,412
Circles, segments, strips, etc.	52	12,804	19	3,058	10	3,324
Rods and bars	2	332	4	818	5	1,169
Circles and ingots bored or unbored for cyanide gold process; blocks for marine boilers	10	772	—	—	—	2
Totals	200	£48,976	137	£41,997	135	£58,907

(a) Includes "plates for engravers, lithographers, other than prepared zinc plates". Lithographers in Australia nowadays use almost entirely only zinc sheets (called "plates" in trade parlance), which are all imported for all sizes of offset/lithography presses other than small machines of foolscap and foolscap-sheet, not further manufactured than plated, etc., for lithographic purposes—that is, prepared zinc plates for use by lithographers. (The use of lithography plates comprising layers of different metals, known as bi-metallic and tri-metallic plates, began in recent years in Australia, but imports of plates would be quite small as yet—see Chapter 5, "Paper Products, Printing, Signwriting, Photographic Materials".) The only types of plates used by process engravers are zinc plate and copper plate, which, where imported, are imported in prepared condition, that is polished, ready for engraving. It appears then that the "plates for engravers, lithographic, other than prepared zinc plates" comprises almost entirely process-engravers' copper plate, and the cost a ton (see next table) strongly suggests that this is so. It is probable that the small but regular imports of prepared copper sheets (that is, polished ready for etching, but not etched with the printing image) imported for the two gravure printers in Australia using such sheets are included in this item.

CLEARED IMPORTS OF "PLATES AND SHEETS" (a):

	1948-49		1949-50		1950-51	
	tons	£	tons	£	tons	£
Zinc and spelter sheet—						
Lithographic—						
0.005 in. and above	16	2,123	5.7	2,872	4.5	3,254
Below 0.005 in.	3	1,234	6.6	1,565	11.5	961
Other	19	3,357	12.3	£4,437	16.0	£4,215
Zinc plates, prepared for process engravers	17	3,413	34.1	3,498	24.2	5,897
Total, zinc plates and sheets	55	1,613	31.6	5,792	17.4	6,195
Plates for engravers, lithographers, other than prepared zinc plates (b)	91	8,383	78.0	£13,727	57.6	£16,307
Totals, "plates and sheets"	45	26,796	35.1	£24,348	62.0	£38,048
	136	£35,179	113.1	£38,075	119.6	£54,355

(a) This table comprises the actual clearances through Customs for the five tariff classes of products which collectively make up the Imports Statistical Item 4333, "Zinc and Spelter—Plates and Sheets (including prepared for Process Engravers and Lithographers)". (See Appendix IV for explanation of clearance statistics and total imports statistics.)

(b) See footnote to table of "Total Imports", above.

Exports of zinc shapes are mainly to New Zealand and the Far East. (An additional item of zinc that is exported is zinc dust, or blue powder, mainly to New Zealand and Pacific Islands. In 1949-50, 28 tons, valued at £4,318, was exported, and in 1950-51, 26 tons, £4,672.)

Imports of zinc shapes are mainly from the United Kingdom.

Manufacture of PROCESS-ENGRAVERS' ZINC SHEET is now firmly established in Australia. The product is stated by leading process engravers to be equal to or better than the best imported, particularly in hardness and polish, and is being successfully sold outside Australia. The company concerned, which began rolling of zinc before the 1939-45 War, has been so successful with the thickening and polishing methods devised and patented by it for process-engravers' plate that the methods are now in use by some overseas manufacturers. The same company makes zinc strip, including

strip used for plates for small office-type offset/lithography presses, but has not entered into making of wide sheet. PRECISION-ROLLED LITHOGRAPHERS' ZINC SHEET for presses of the sizes used in the printing industry proper would probably not be economical in Australia. The quantity required annually is not large, because a used sheet (in trade terms, a "plate") can be re-used many times—the printing image, a planographic etching, is removed by a simple graining process, and the plate is ready again for sensitising, exposure and etching to create a new printing image.

There are no statistics of production, imports or exports of IMPACT-EXTRUDED PRODUCTS of zinc. There appears to be adequate capacity to meet the demand. (The principal manufacturer of dry-cell batteries in Australia is, through a subsidiary company, a manufacturer of zinc strip, and fabricates its cell cans from strip.)

TIN

TIN FOIL is rolled by one company in Australia, but only in small quantity, for dental use. Imports of "tin leaf and foil" are practically all from the United Kingdom, and in 1949-50 were 382,234 lbs., valued at £158,886, and in 1950-51, 202,098 lbs., £122,589.

TIN SOLDERS in various alloys in wire and other forms are made in Australia, as are also COLLAPSIBLE TUBES of tin (and of tin-lined lead). Capacity appears to be adequate to the demand. There are no published production statistics for those items.

PRECIOUS METALS

The fabricating in Australia by a few companies of precious metals, alloys containing precious metals, and one or both with base metals, into finished shapes for further processing by goldsmiths, silversmiths and manufacturing jewellers, is an established industry that has capacity to spare in meeting most of Australia's requirements for shapes from one or both of those metals, including all forms of silver solders and low-temperature brazing alloys, and plating and pharmaceutical salts. Australia's requirements for finished shapes of metals and alloys of the platinum group could be satisfied by the precious-metals fabricators in Australia,

but because Australia produces practically nothing of these metals from indigenous sources, it has been usual to import the metals in the fabricated condition ready for completion into final condition, such as laboratory equipment of platinum (see below).

Official statistics of materials used and production of finished shapes, powders, salts, alloyed materials, etc., containing precious metals are not collected as specific items.

Imports of those finished shapes, powder and salts of precious metals that are separately published in official statistics in the years 1949-50 and 1950-1 were—

IMPORTS:

	1949-50		1950-51	
	ozs.	£	ozs.	£
Platinum and Platinum Group Metals and Alloys—				
Blocks, rods, bars, plates, sheets, strips, pipes and tubing	220	5,974	493	13,703
Scrap, pigs, ingots, blocks, rods, bars, angles, channels, tees, plates, pipes and tubes plain or not further manufactured than plated, polished or decorated . . .	428	4,672	582	7,997
Wire and manufactures of wire	2,373	18,275	10,933	30,571
Metal powder	1,263	17,881	726	21,047
Gold and Silver—				
Gold leaf and foil	913	5,341	4,471	12,023
Gold-plated or silver-plated wire	—	28,373	—	42,184

Practically all of these imports came from the United Kingdom.

Exports of fabricated shapes of precious metals, etc., are not separately stated in official statistics, but are reported to be small other than for 22-ct. gold strip made from gold of Fijian origin specifically for export to be sold in the free international market for gold.

Three of the leading fabricators of precious metals also make laboratory and processing equipment of platinum, such as crucibles and dishes, and do platinum cladding of plant and equipment. One of these manufacturers is an associate company of Johnson, Matthey & Co. Ltd. U.K. (which also has associate companies in Canada and U.S.A., and agents throughout the world), a company which is pre-eminent in

precious-metals processing, particularly of platinum; the company mines large deposits of platinum minerals in the Transvaal, South Africa, and electrolytically refines the mineral at its U.K. works. Its Australian associate, in addition to platinum crucibles and dishes, etc., also makes rhodium-platinum thermocouples and specifically-prepared platinum catalysts. Statistics of the value of Australian production of equipment of platinum are not collected. The value of imports of equipment of platinum—"retorts, pans, condensers, cylinders and other articles used in the manufacture of acids and in laboratories and made of platinum"—were valued at £2,398 in 1948-49, £2,031 in 1949-50 and £4,701 in 1950-51; the imports were all from the United Kingdom.

FOUNDRIES, FERROUS AND NON-FERROUS; AND DIECASTING

FERROUS FOUNDRIES

Generally speaking, most of the classes of foundries found in overseas countries are in existence in Australia, although the Australian scale of operations is smaller.

Output of nearly all foundries has been restricted and much capacity unused, due principally to the shortage of pig iron, skilled moulders, and metallurgical coke. The use of low-grade coke and scrap materials has made it difficult to assess the true productivity rate per man hour or to compare current productive capacity with previous years.

On information available, however, it is certain that overall productivity and productive capacity has increased markedly since pre-war years, when it was at a level of slightly less than 200,000 tons a year. This increase is due primarily to the establishment of several large and highly efficient foundries, some of which are adjuncts to the motor, tractor, and agricultural implement makers.

Owing to the scarcity of skilled labour and the necessity to increase efficiency, much thought has been, and is being, given to fuller mechanisation in jobbing and repetition casting.

This is being done in order to meet the requirements of a wider industrial economy and the precision demands of modern engineering practice. There is, however, a section of the industry which still operates foundries that, by modern standards, are outmoded.

The ferrous foundry industry in Australia is generally fairly well developed and has the technical but not all the mechanical resources to cater for most Australian industrial needs. Over £3 million were expended in the industry in 1951-52, specifically for improvements in casting and crane capacity, sand handling, mechanised moulding and core-making facilities etc. to meet the increased need for specialised work, particularly in the repetition-casting field.

The following table shows production of finished iron and steel castings by States during 1950 and "effective" demand and "effective" capacity figures for 1951. These figures include all the foundries conducted by the B.H.P. iron and steel group, government workshops and other "captive" foundries, as well as the regular production and jobbing foundries which cater for general industry.

PRODUCTION, DEMAND, CAPACITY:	Production 1950		Estimated Effective Demand 1951		Estimated Effective Capacity 1951	
	Iron	Steel	Iron	Steel	Iron	Steel
	tons	tons	tons	tons	tons	tons
New South Wales	160,000	17,000	220,000	25,500	220,000	25,000
Victoria	71,000	8,500	110,000	15,500	106,000	14,500
Queensland	23,500	1,200	35,000	7,500	31,000	2,300
South Australia	26,500	850	37,000	6,500	39,000	1,500
Western Australia	17,000	4,900	25,000	7,500	21,300	8,500
Tasmania	3,000	nil	8,000	2,500	5,700	nil
Totals	301,000	32,450	435,000	65,000	424,000	51,800

The foregoing table is based on the present pattern of production and demand. Capacity is also estimated on the same basis. If, however, an entirely new field of demand for repetition castings arose, say, for 20,000 diesel engine blocks, frames and associated parts, there is insufficient suitable capacity available to meet such a demand and a new specialised type of capacity would have to be installed.

In certain fields of industry the demand for castings in 1952 shows a tendency to decline. This is particularly so in the builders' hardware, stovemaking and bathmaking groups. On the other hand the demand for engineering castings, railway and transport parts, automotive engines, etc., remains very high. In 1952 there is also a freer availability of coke and pig iron than in 1951 and it is expected that production will be greater. The gap between supply and demand in 1952 should therefore decrease substantially.

The following table is an estimate of the percentage distribution of tonnages of castings required by a range of Australian industries. This table illustrates the basic nature of the foundry industry and the industries which constitute its principal markets—

INDUSTRY REQUIREMENTS.	1951 %
Agricultural machines and equipment (excluding tractors)	8.0
Construction and excavating equipment (excluding tractors)	2.1
Mining (excluding open-cut)—	
(a) Metalliferous	1.7
(b) Other	2.5
Smelting, refining and ore-dressing equipment	2.5
Steam-raising and steam prime-mover equipment	3.7

Locomotives and railways rolling stock . . .	6.7
Ship and boat construction	3.1
Internal-combustion engines—	
(a) Petrol and kerosene for motor vehicles, pumping units, lighting sets, etc.	2.4
(b) Diesel (stationary, traction, marine) . . .	1.2
Motor vehicles, trailers and tractors (excluding engine units)	1.9
Electric motors, generators and other industrial electric equipment	2.2
Machinery and associated equipment for metal-working	8.4
Industrial processing equipment and machinery (excluding 11)	9.6
Gas and air compressors	0.5
Pumps, fans, blowers	3.0
Valves (steam, air, water, oil, etc.)	4.4
Cast pipes, fittings, gratings, covers, etc. . .	25.0
Stoves, ovens, ranges (industrial and domestic)	2.0
Baths, basins, sinks	3.6
Hardware for domestic and commercial purposes (excluding 17 and 18)	1.5
Miscellaneous	4.0
Completing	100.0%

Capacity

If the industry were able to work to optimum capacity, having a free flow of labour, materials, power, etc., about 550,000 tons of finished iron and steel castings could be produced annually. Present effective capacity, i.e. with existing labour and facilities, but with a free flow of materials and power, etc., is about 470,000 tons a year. Production at the present time in all ferrous foundries averages about 60 per cent. of optimum capacity and about 70 per cent. of effective capacity. However, in some jobbing foundries it is as low as 30 per cent. of capacity, while in production or repetition foundries it is as high as 75 per cent. of effective capacity. There are instances of foundries working at 100 per cent. of capacity, but these are few.

Production and Demand

The 1951 production of ferrous castings was about the same as 1950, that is, 33,000 tons of steel, 9,500 tons of malleable, and about 295,000 tons of grey-iron. An examination of the industry suggests that the effective demand in 1951 was in the region of 65,000 tons of steel, 20,000 tons of malleable and nearly 415,000 tons of grey-iron. The demand for castings in 1952, however, shows a decline of between 10 and 20 per cent. in some cases, particularly from those industries associated with light engineering, such as the makers of baths, stoves, refrigerators, tractors, hand tools, laundry machinery, small combustion engines, construction equipment and heavy earthmoving equipment. The 1952 demand for steel and malleable castings remains high, but it is estimated that the demand for iron castings may have declined by 50,000 tons. With the exception of cast-iron pipes and fittings, imports of iron and steel castings are a negligible percentage of local production. The low rate of importation does not imply that the demand is being satisfied, as such factors as disproportionately high freight costs and strong protective tariffs, plus inspection and testing difficulties have had the effect of depressing the tonnage of castings that would otherwise be imported. Imports during 1950-51 were 23,000 tons of cast-iron pipes and fittings and about 1,000 tons of other castings, including malleable pipes and fittings, wheels, etc., and of forgings.

The Australian industry looks to the local foundries to supply the greatest bulk of its requirements, and demands are likely to expand in many cases because of the continuing development in the allied industries. The increasing popularity of welded (fabricated) components, however, may affect the demand for castings, but the extent of its influence is problematical.

The following table of employment in the industry includes about 2,000 administrative and technical staff directly associated with the production of castings. The second column in the table shows the number of employees (additional) in machine shops directly attached to the industry.

EMPLOYMENT:	1951	
	In Foundries	In Foundry Machine Shops
New South Wales	7,690	5,411
Victoria	4,059	2,512
Queensland	1,239	1,588
South Australia	1,652	1,764
Western Australia	1,221	1,659
Tasmania	236	223
Totals	16,097	13,157

The labour force is predominantly male, less than 2 per cent. being female. Most of the latter are confined to clerical and administrative occupations, although in a number of instances, largely a survival of wartime practice, a few are still employed on machine core-making. Less than 6 per cent. of the total labour force is juvenile.

Foundries in New South Wales and Victoria are responsible for over 70 per cent. of materials used and castings produced. The iron and steel works foundries in New South Wales are capable of producing massive castings up to 80 tons finished weight. About 35 other foundries (25 of which are located in New South Wales and Victoria) are capable of making iron or steel castings of 10 tons and over, individual weight.

Planned Expansion

The establishment and completion of a number of new mechanised foundries in several States, the completion of a very modern malleable foundry in South Australia and particularly the modernisation of important existing foundries in all States illustrates the desire of the industry in general to increase capacity and to develop technique.

An indication of the advances being made in the industry, especially towards repetition (mass-production) casting, is shown in the following table of expenditure during 1951-52 for developmental purposes—

DEVELOPMENT EXPENDITURE:	1951-52
Jobbing and repetition iron-foundries . . .	£1,250,000
Jobbing and repetition iron and steel foundries	175,000
Repetition iron foundries	550,000
Jobbing iron foundries	425,000
Steel foundries	600,000
Total	£3,000,000

It is notable that in spite of the unpopularity of the industry with financial institutions much of its own finance is being spent on improving facilities and conditions to combat the shortage of labour. Latest information suggests there is an improving trend in labour supply, and some skilled moulders appear to be gradually returning to the trade. This is more noticeable in New South Wales than in other States, especially since the beginning of 1952. Casting capacity, as a result of new equipment and facilities, will be increased, but raw materials may not be available to meet this additional capacity.

Raw Materials

The raw materials supply position has been the most important factor confronting ferrous foundries. Pig iron, including imports, available to the industry in 1950 (including the steel-works foundries) totalled about 225,000 tons, against a demand for about 350,000 tons. Hard-coke requirements for foundry use are about 95,000 tons in 1952, while availability is in the region of 85,000 tons. Ferro alloys for special castings are likely to be available at about two-thirds of needs and substitute alloys will have to be used. During early 1952, the supply position of most foundry raw materials, except the ferro alloys, improved, and as a consequence of the fall in the demand for certain types of castings it is expected that the raw materials position in 1952 will be less acute than in 1950 or 1951.

Opportunities Within the Industry

As will be seen, the industry has realised that it could well do with a considerable amount of development, particularly in technique and in the mechanised handling of raw materials, moulds, cores and sands, etc. This is especially applicable to the older foundries and small privately-owned establishments. Nevertheless, the extent to which this can be done is limited, particularly in the case of jobbing foundries where existing methods appear economical because of the lower capital outlay, etc. There are, however, many opportunities in this section of the industry for modernisation of layout and technique. Opportunities also exist for highly-mechanised production foundries of the specialised type, for example, the casting of engine blocks and parts for automotive and other types of power units. It may be difficult to obtain the necessary labour, consequently the newcomer must do everything possible to attract the younger generation by

means of up-to-date working conditions and a more scientific approach to management. More attention will also have to be paid to the employment of metallurgists and other trained staff to control the various foundry operations.

There are possibilities for the establishment of additional foundries to specialise in the manufacture of heat-resistant, corrosion-resistant and abrasion-resistant alloy castings for the chemical, gasmaking, mining, steelmaking and other important industries, and for special valve castings for the oil refineries.

It is important to note that good supplies of natural moulding sands for iron and non-ferrous castings are obtainable only from one State in Australia—Victoria. New South Wales sands, while excellent for steel castings, are only fair for iron and other castings. However, supplies of material for the preparation of good

NON-FERROUS FOUNDRIES

The non-ferrous foundry industry is an important and sizeable section of the Australian manufacturing economy. There are more than 400 foundries producing non-ferrous castings at the present time, ranging in size from small "backyard" establishments employing a few persons to large, well-organised plants operating on mass-production lines. About 80 per cent. of the total number of foundries are located in Victoria and New South Wales, whilst over 90 per cent. of the total number are in the metropolitan areas of the several capital cities.

Firms in the foundry industry usually engage in either jobbing or repetition work. The types of castings produced may be divided into two broad classes as follows: castings in copper and copper-base alloys; and castings in light alloys. Most of the conventional types of alloys are cast in Australia. Copper-base alloys include brasses, bronzes (phosphor, aluminium and manganese), gunmetal, beryllium-copper, monel metal, etc. In the light-alloy field, castings are produced in a wide range of aluminium alloys, including heat-treatable duralumin and aircraft-specification types. Magnesium-alloy castings were made during the 1939-45 War.

Complex castings of reasonable size and weight can be produced. In the copper-based alloy field, monel castings up to 1 cwt., manganese-bronze up to 30 cwt., aluminium-bronze, phosphor-bronze and specification bronzes up to 2 tons can be made. Special manganese-

synthetic sands and binders are freely obtainable. Supplies of fair grades of bentonites and clays are obtainable from two deposits in Australia, but Wyoming bentonite is regularly imported from U.S.A.

With regard to foundry equipment, up to 90 per cent. of the types used are made in Australia, in some cases under licence to recognised overseas manufacturers. Electric furnaces in capacities up to 15 tons are constructed by manufacturers in Australia, but delivery is delayed; moulding machines, sand-mixing and sand-testing equipment, are all made in Australia, with prompt delivery (see Chapter 12). Practically all pyrometric equipment is imported; but it is freely available. Altogether, most of the machinery used in up-to-date foundries can be secured without recourse to importation.

bronze castings (for ships' propellers) weighing up to 5 or 6 tons are cast by marine foundries in Sydney. Aluminium-magnesium castings up to 700 lbs. and aluminium-silicon castings up to 100 lbs. have been produced at a military-aircraft establishment in Victoria.

There is a steady demand for nearly all types of non-ferrous castings. In the past, largely because of shortages of metals and of labour, long delivery delays were experienced. However, there has been a slackening of demand recently and most requirements are now being met. Increasing capacity for manufacture of certain items of plumbers' brassware by hot brass stamping has tended to affect the overall demand for non-ferrous castings. Total production is estimated at some 40,000 tons of copper-based alloys and 5,000 tons of aluminium-based alloys a year. Actual capacity would be nearer 60,000 tons a year.

Many foundries engaged in jobbing work are small, poorly equipped, and lacking in modern methods of technical control and materials handling. The most efficient foundry practice is to be seen in foundries producing light-alloy castings for the aircraft industry. (The principal manufacturer of complete aircraft—see Chapter 10—operates what is probably the most efficient light-alloy foundry in Australia.) It is felt, on the whole, that there is considerable scope for improving the technological efficiency of many of the smaller firms engaged in the non-ferrous foundry industry.

DIECASTING

The diecasting industry in Australia developed considerably during the 1939-45 War and has expanded still further since the war ended, to meet ever-growing demands. With the exception of two or three diecasting establishments which are attached to engineering companies, the industry is specialised. The majority of the firms engaged rely to a very large extent on jobbing work, although proprietary lines are manufactured. Whilst some of these firms do both pressure and gravity castings, the tendency appears to be more to specialise in one or the other.

There are no official statistics to indicate the value of production from the diecasting industry, but demands upon it have been steadily increasing. Probably the greatest demand emanates from the motor-car industry for motor-car hardware. Other fields where pressure diecasting has become a popular method of production are in the manufacture of builders' and cabinet-makers' hardware, refrigeration hardware, toys, aircraft parts, plumbers' brassware. Gravity castings are being used for the manufacture of components

for washing machines, domestic utensils (pressure cookers, frying pans, etc.), electrical-switchgear components, builders' and refrigeration-cabinet hardware, vacuum-cleaner parts, pulleys, and numerous other items.

The chief diecasting alloys used are "Ezda" (of similar specification to "Mazac") and other zinc-based alloys, aluminium bronze and aluminium alloys, and the chief metals involved are zinc, aluminium, copper and magnesium. The shortage of aluminium has enforced a degree of rationing to the trade. Many manufacturers are not working to full capacity, mainly because of the inadequacy of die-casting capacity and the shortage of die-casting alloy. Most diecasters make their own dies.

Recent installation of additional hot-brass pressing capacity in Australia may in the near future relieve much of the strain on the demands of this industry, as many of the items now being produced by diecast methods could be manufactured just as easily and probably more satisfactorily by the hot-pressing method.

FORGES, FERROUS AND NON-FERROUS; AND BLACKSMITHING

FERROUS FORGING

The steel-forging industry is firmly established and produces a wide range of types, sizes, and shapes of forgings. The firms comprising the industry are engaged in one or more of blacksmithing or light forging; forging to dies; heavy forging.

Most of the larger firms undertake custom or jobbing forging, usually as a complementary function to the production of forgings for their own manufacturing requirements. Most of the firms engaged in the industry are concerned with light and drop forging and employ conventional types of forging equipment, such as steam and pneumatic smith hammers, steam and friction drop hammers, helve hammers, forging rolls, etc. Forging machines for up-setting are installed at several plants. There is also a limited amount of die-forging press capacity for the rapid production of forgings to close tolerances—the capacity for such work in Australia will soon be considerably extended.

Heavy forging can be undertaken by only a few establishments. Capacity includes a number of presses of 1,000-ton and 1,500-ton ratings, whilst one company is installing a 5,000-ton press procured by the Commonwealth Government as German war reparations.

Certain Commonwealth Government factories also produce drop and heavy forgings for commercial purposes when their capacity is not being fully utilised on defence and other Government contracts. The various State Government railway workshops constructing locomotives and rolling stock are provided with their own forging facilities.

The demand for forgings is considerable, particularly as a result of the expanding local production of motor vehicles, tractors and aircraft, and the general growth of the engineering industries. Forging firms, for example, are now producing a wide range of components, such as crankshafts, connecting rods, and axles for the motor-vehicle, aircraft, marine, and earth-moving-equipment industries; railway tyres, axles and wheel centres; parts for agricultural

implements such as plough discs, coulters and chaffcutter knives; pipe wrenches, spanners and other hand tools; globe valves; pipe flanges; rock-drill bits, etc. Various component parts are being forged for processing equipment used in such industries as confectionery, textiles, meatworks, plastics, food, cement, chemicals, machine tools, materials handling, mining and excavating, etc.

Many forging firms are not working at their full capacities owing to shortages of forging steel and, to a lesser extent, labour. As a result, there has been delay in filling orders for some types of forgings.

There are no published statistics of production of forgings in Australia. Imports of forgings appear to be quite small, but some items are significant, being of a type—such as crankshafts of very large throw—for which a large enough press is not in use in Australia. Exports are very small.

It is anticipated that the engineering industries will continue to expand in both volume and variety of production, and that this will almost certainly involve an increasing demand for all types of steel forgings. The forging industry recognises that it will be called upon to meet these growing demands, and several important developments have been announced. The principal drop-forging producer, for example, has formed a company of £500,000 capital to operate a new plant in Victoria, in which will be installed the latest types of high-production heavy presses to press-forg to dies; production is to begin in July, 1952. Another new development has been the formation of a £1 million company to make drop forgings, including large forgings such as heavy axles for motor vehicles; the plant is being established at Melbourne, Vic., and it is expected that production will begin in September, 1952. The Australian company joins the leading manufacturer of automotive replacement parts in Australia with one of the largest drop-forging companies in the United Kingdom.

NON-FERROUS FORGING

There are no published statistics of production, imports and exports of non-ferrous forgings in Australia. The activity, other than for hot-brass pressing, is part of the forging activity as a whole, most of the output of non-

ferrous forgings coming from a few of the larger ferrous forges. Forgings are made of various non-ferrous metals and alloys, for many uses, including Armed Services aircraft. The established capacity appears to be adequate.

BLACKSMITHING

Over recent years blacksmithing has declined as an independent industry. Although many small blacksmith shops (usually also doing farriery) continue to operate in country towns, both small and large, those in city areas are either ceasing to exist independently or are changing their structure, by the addition of plant such as power hammers, to handle work usually beyond the range of artisan blacksmiths. The development of machine-forging capacity for mass production and the continued use of light hammers and forges in numerous engineering concerns, most of which cater for trade as well as their own requirements, generally meet the needs of industry for proprietary and maintenance and repair work.

Although skilled blacksmiths are difficult to obtain, it is considered generally that there is sufficient capacity to meet the needs of industry, which is in most cases self supporting. However, because of more lucrative and less ardu-

ous and cleaner occupations offering, there are few apprentices and trainees entering the blacksmithing trade. Current procedure is to train labour to operate light hammers or presses.

Art metal wrought iron work was originally produced by founders and blacksmiths, but the current trend, largely because of the shortage of skilled men, is to fabricate and form with the use of jigs most iron work, such as gates, doors, screens, grilles, balustrading, etc., production of which has increased recently.

On the whole, there is ample capacity, between the trade as an independent body and the engineering and forging concerns, to meet all the requirements of industry for new production and for maintenance and repair work. A large proportion of the blacksmithing and light forging capacity is contained in the agricultural-implement making and general-engineering industries, and it cannot be said that a decline in blacksmithing services is evident.

Part Three: Basic Statistics

COMPARATIVE STATISTICS, 1938-39/1949-50

NUMBER OF ESTABLISHMENTS AT 1938-39 AND 1949-50

NUMBER OF EMPLOYEES AT 1938-39, 1949-50, JUNE 1950, SEPTEMBER 1951

Activity (Statistical Sub-classes used by Commonwealth Statistician, 1949-50)	Establishments		Employees			
	1938-39	1949-50	1938-39	1949-50	June 1950 (a)	Sept. 1951 (a)
	no.	no.	no.	no.	no.	no.
Smelting, Converting, Refining, Rolling of Iron and Steel (b)	(c)363	(d)30	(c)19,352	(d)11,509	(e)20,701	(e)21,137
Foundries (Ferrous) (f)		353		6,346		
Pipes, Tubes and Fittings—Ferrous (g)		39		5,775		6,314
Extracting and Refining of Other Metals; Alloys (h)	42	62	5,532	7,394	6,149	
Non-ferrous Metals—Founding, Casting, etc. (j)		391		6,751	(e)13,694	(e)13,723
Non-ferrous Metals—Rolling and Extrusion (l)	(k)228	10	(k)5,029	3,373	4,050	4,023
Lead Mills (m)	9	(n)10	92	(n)166	165	169
Totals (o)	642	895	30,005	41,314	44,759	45,366

STATISTICAL SUMMARY, 1949-50

EMPLOYMENT, MALE AND FEMALE

SALARIES AND WAGES PAID, IN TOTAL AND PER PERSON ENGAGED

VALUE OF PRODUCTION

VALUE OF MATERIALS, POWER, FUEL, REPAIRS, etc. }

See Explanations, Appendix IV

VALUE OF OUTPUT

Activity (Statistical Sub-classes used by Commonwealth Statistician, 1949-50)	Employment			Salaries and Wages Paid		Value of Production	Value of Materials, Fuel, etc. Used	Value of Output
	Males	Females	Persons	Total	Per Person Engaged			
	no.	no.	no.	£'000	£	£'000	£'000	£'000
Smelting, Converting, Refining, Rolling of Iron and Steel (b) (d)	11,154	355	11,509	6,978	606	12,784	35,263	48,047
Foundries (Ferrous) (f)	6,063	283	6,346	2,985	470	4,648	2,457	7,105
Pipes, Tubes and Fittings—Ferrous (g)	5,273	502	5,775	2,788	483	3,859	5,333	9,192
Extracting and Refining of Other Metals; Alloys (h)	7,153	241	7,394	4,324	585	15,718	40,901	56,619
Non-ferrous Metals—Founding, Casting, etc. (j)	6,020	731	6,751	2,949	437	4,790	5,913	10,703
Non-ferrous Metals—Rolling and Extrusion (k)	3,026	347	3,373	1,731	513	3,285	7,738	11,023
Lead Mills (m) (n)	130	36	166	76	458	172	369	541
Totals (o)	38,819	2,495	41,314	21,831	526	45,256	97,974	143,230

Explanatory Footnotes to Both Tables

- (a) These employment figures are taken from monthly payroll-tax returns and differ slightly from the other employment figures, which are supplied on annual factory returns.
- (b) Also includes ferrous forging (when a trade service activity); and drawing of bright steel bar. (See also footnote (d) below.)
- (c) At 1938-39 the sub-class "Smelting, Converting, Refining, Rolling of Iron and Steel" (the title was not subsequently changed) also included—
- (i) Ferrous foundries of a type that were included in the subsequent (1945-46 and onwards) sub-class "Foundries (Ferrous)". (Other ferrous foundries classifiable as such were also included in the then sub-class "Engineering (not Marine or Electrical)", a sub-class now non-existent.)
- (ii) Engineering activities of a type that were included in the subsequent (1945-46 and onwards) sub-class "Plant, Equipment and Machinery including Machine Tools". (Other engineering activities, not being marine or electrical, were included in the then sub-class "Engineering (not Marine or Electrical)", a sub-class now non-existent.)
- (iii) Pipes, tubes and fittings that were included in the subsequent (1945-46 and onwards) sub-class "Pipes, Tubes and Fittings—Ferrous".
- See also footnote (c), Part Three, Chapter 12, "Machinery, Plant, Equipment, Apparatus, Not Elsewhere Included".
- (d) Of the 30 establishments, eleven are sections (blast furnaces and direct metal iron foundries, open-hearth furnaces and direct metal steel foundries, rolling mills, forge shops) of four works of the B.H.P. group—B.H.P. Newcastle, Commonwealth Steel, A.I.S., B.H.P. Whyalla. The iron works at Wundowie, W.A., a steelworks and a steelmill at Melbourne, Vic., and several forges in N.S.W. are included. Several steel foundries appear to have been inadvertently included in the sub-class. The sub-class does not include two steelmills engaged in rolling and coating of steel sheet—black, terneplate, galvanised, "Zincanneal"; those two mills are included, in official statistics, in a sub-class entitled "Iron and Steel Sheets", and that sub-class is joined with "Sheet Metal Working,

Pressing and Stamping" into, in effect, one sub-class (see footnote (g), Part Three, Chapter 12, "Machinery, Plant, Equipment, Apparatus, Not Elsewhere Included", for statistics, and this chapter, "Metals, etc.", for description of the two mills).

The by-product coke-oven sections (including coal-washing plant), general foundries, cast-iron pipe plant, ferro-alloy plant, tungsten and tungsten tool-tip plant and electric-power plants, operated by the B.H.P. group at either B.H.P. Newcastle or A.I.S. or at both works, are not part of the sub-class and are included in the sub-classes appropriate to those activities.

- (e) Separate figures for each sub-class of this group were not published.
- (f) Does not include foundries which are an integral part of another activity, such as manufacture of stoves and ovens, cast pipes and fittings, agricultural machinery, motor vehicles and tractors, aircraft engines, direct metal casting at integrated iron and steel works.
- (g) Also includes cast-iron and cast-steel pipes and fittings; structural steel pipe; close-joint and welded conduit (electrical); and pipe manipulation.
- (h) Begins at smelting stage and includes all metals and alloys other than iron, steel and steel alloys, but includes ferro-alloys; also includes scrap recovery and de-tinning.
- (j) Also includes non-ferrous forging and hot pressing; brass-finishing; and coppersmithing. Does not include diecasting, which is included in the sub-class "Plant, Equipment and Machinery, including Machine Tools" (the statistics of which, in this study, are included in Chapter 12, "Machinery, Plant, Equipment, Apparatus, Not Elsewhere Included").
- (k) The two sub-classes comprised, at 1938-39, the sub-class "Brass and Copper".
- (l) Also includes drawing. Applies to copper and copper alloys (brasses, bronzes, etc.), aluminium and aluminium alloys, zinc, magnesium; but does not include lead (see sub-class "Lead Mills" this chapter), or precious metals (see sub-class "Jewellery", Chapter 12, "Machinery, Plant, Equipment, Apparatus, Not Elsewhere Included").
- (m) Includes lead rolling and extruding; shot making; and collapsible tubes.
- (n) Establishments in Queensland classifiable within the sub-class "Lead Mills" were included in the sub-class "Other Metal Works". (In this study the activities and statistics of the sub-class "Other Metal Works" are included in Chapter 12.)
- (o) Consideration and comparison of totals must take into account the effects stated in footnotes explaining the composition of certain sub-classes and figure units.

Chapter 10:

TRANSPORT EQUIPMENT

Part One: Structure of Established Manufacturing Activities

MANUFACTURE and maintenance of transport equipment are established in Australia as listed below. The listing is intended to be reasonably indicative, but not necessarily fully inclusive.

THE MOTOR-VEHICLE INDUSTRY (excluding Motor Cycles)

The motor-vehicle industry in Australia may be divided into the following broad groups—

Manufacturers	Parts and Accessory Manufacturers
Assemblers	Mechanical Repairers
Body Builders	Body Repairers

Although there is some overlapping of activities as between these groups they are reasonably distinct and form the major features of the industry. In 1949-50 there were 5,330 establishments in the industry in principal occupation and employment size as follows—

Activity	Up to 10 Persons		11 - 20 Persons		21 - 50 Persons		51 - 100 Persons		Over 100 Persons		Total for Activity	
	Est.	Pers.	Est.	Pers.	Est.	Pers.	Est.	Pers.	Est.	Pers.	Est.	Pers.
Construction, Assembly .	12	56	14	213	16	509	9	701	21	9,885	72	11,364
Motor Bodies	340	1,395	58	834	56	1,763	8	585	14	11,638	476	16,215
Motor Parts, Accessories	63	303	22	300	25	810	8	590	15	3,135	133	5,138
Repairs	3,937	16,047	443	6,225	191	5,600	57	3,962	21	3,699	4,649	35,533
Totals, Whole Industry .	4,352	17,801	537	7,572	288	8,682	32	5,838	71	28,357	5,330	68,250

(Assembly of motor cycles is included in "Construction and Assembly", and manufacture of side-cars is included in "Motor Bodies". Workshops engaged wholly or mainly in motor-vehicle body repairs are included in "Motor Bodies". The few establishments in Tasmania engaged wholly or mainly in building of horse-drawn vehicles are included in Motor Bodies".)

The establishments each employing over 100 persons in 1949-50 were classified as follows—

Activity	101 - 200 Persons		201 - 300 Persons		301 - 1,000 Persons		Over 1,000 Persons	
	Est.	Pers.	Est.	Pers.	Est.	Pers.	Est.	Pers.
Construction, Assembly	10	1,477	2	532	8	4,317	1	3,559
Motor Bodies	4	535	5	1,266	2	892	3	8,945
Totals	14	2,012	7	1,798	10	5,209	4	12,504
Motor Parts, Accessories	11	1,553	—	—	4	1,582	—	—
Repairs	16	2,070	3	758	2	871	—	—
Totals, Whole Industry	41	5,635	10	2,556	16	2,453	4	12,504

The manufacture and assembly of motor vehicles and the building of motor-car bodies in Australia has, in the main, been expanded through the activities of the large overseas motor-vehicle manufacturers. These manufacturers (from U.S.A., Canada and United Kingdom) have established manufacturing, assembly or body-building plants in Australia or developed existing Australian businesses. The present plans of these overseas manufacturers anticipate further development of this section of the Australian industry.

On the other hand, Australian distributors of motor vehicles (as distinct from those owned or controlled by overseas interests) play a not insignificant part in the assembly of vehicles, including, in some instances, body building from imported panels. Many overseas manufacturers, notwithstanding the fact that some are established in Australia, are still dependent on local distributors for a considerable volume of assembly work.

The manufacture of special bodies (most bodies other than car bodies), the production of components, and repairs and servicing activities have largely developed through the expansion of Australian businesses. There is, however, some tendency for overseas component manufacturers to be directly interested in the Australian market, either through association with existing Australian firms or by the establishment of manufacturing units in Australia.

Manufacturers

There are four companies producing a range of vehicles containing a substantial quantity of Australian-made components. Some components for these vehicles are imported, some produced by the company concerned, and others obtained elsewhere in Australia. The Australian content varies considerably as between the different vehicles produced by them. It is the policy of these manufacturers, and also of many assemblers, to increase the Australian content of their vehicles. Three of the companies concerned have large body-building establishments where they press and fabricate bodies. Two have foundries and one a small forging unit. The activities of these companies are directed mainly to the production of their own motor vehicles, but one company

presses and assembles some truck cabins and also builds bodies from imported panels for other Australian motor firms which lack the necessary body-building facilities.

In addition to vehicles which are substantially of Australian origin these companies also assemble vehicles which are imported as "knocked down" units, using in such instances a limited but varying range of Australian parts.

The activities of these manufacturers are, in the main, concentrated in Victoria, but one operates solely in South Australia, and the largest has its body building establishment in that State. Three of the companies have, in most other States, branches which are generally directed to assembly and wholesale marketing operations through their distributors and/or dealers.

The Australian companies under discussion are either owned or substantially owned by parent American or Canadian organisations. The parent companies comprise the three largest manufacturers of motor cars, and one of the largest truck manufacturers in North America, as below—

CHRYSLER

Chrysler Australia Ltd. is controlled by the Chrysler Corporation of America, with a minority ordinary share-holding by Australian distributors of Chrysler products.

The Chrysler organisation distributes throughout Australia the Chrysler range of motor vehicles varying from passenger cars to 6-ton trucks. Vehicles are imported from Canada in a "knocked down" condition and assembled in Australia, using a range of Australian-made components. The main mechanical components, such as engines, gear boxes and differential assemblies, for the Chrysler range of vehicles are imported. The Australian organisation is advancing with its plans to increase the Australian content of its vehicles.

The company's manufacturing activities are carried out in Adelaide and consist primarily of motor-body production (including the pressing of panels for the Australian Chrysler range of vehicles) and the production of other pressed metal components, such as fenders, engine hoods, radiator grilles, fuel tanks and chassis cross rails, for motor vehicles. Additional components, e.g., road springs, shock absorbers, wheels, tyres, tubes, batteries, exhaust pipes and mufflers, horns and wiring cables, for the company's vehicles are obtained from other Australian manufacturers.

The assembly of chassis has been carried out by the distributors in the various States, but Chrysler Australia Ltd. has recently commenced chassis assembly operations in South Australia to supply South Australia and Victoria.

The company makes truck cabins (including pressing of panels) and also assembles bodies from imported panels for other motor-vehicle companies in Australia.

The company also makes a wide range of refrigerator components (but does not itself make complete refrigerators, or assemble or market refrigerators).

A division of the company is concerned specifically with manufacture of aircraft parts.

A wholly-owned subsidiary company, Steel Pressings Ltd., makes pressed components for motor vehicles (but not major body pressings) and refrigerators.

FORD

The head office of the Australian Ford organisation, which is owned by the Canadian Ford organisation, is at Geelong, Vic. There are two companies, Ford Motor Company of Australia Pty. Ltd. and Ford Manufacturing Company of Australia Pty. Ltd. The former is concerned with the assembly of chassis, the painting and trimming of bodies, and sales and servicing; and the latter with the manufacture of bodies and chassis parts. The Ford company is one of the three largest motor-body builders in Australia, and presses most panels for the Ford range of vehicles sold in Australia.

There is a branch of the Ford Manufacturing Company at Ballarat, Victoria, and branches of the Ford Motor Company in all States except Tasmania. The various State branches are concerned primarily with the assembly of chassis, the mounting of bodies thereon and the distribution of vehicles. Three branches also do some body building.

The Ford organisation distributes throughout Australia the Ford range of vehicles from 10 h.p. cars and commercials to 5-ton trucks.

Components for the engine, gear box and differential assemblies for the Ford range of vehicles are mainly imported. The bodies (with the exception of the front end) and other pressed metal components, such as fuel tanks, are produced by the company. Components are mainly of Australian origin other than for the above assemblies, the company producing such items as wheels for commercial vehicles, chassis frame members, brake drums and a wide range of other components. Components such as passenger-vehicle wheels, radiators, springs, shock absorbers, tyres, tubes, batteries and horns are purchased from Australian specialist manufacturers.

Although the prime emphasis on local production by the company is on the Canadian V8 model, the Australian content of other vehicles marketed by Ford in Australia, i.e., "Anglia", "Prefect", "Zephyr" and "Consul", is being increased. These latter vehicles are usually equipped with an Australian-made body and other Australian-made items such as radiators, springs, shock absorbers, tyres, tubes, batteries and horns.

In addition to the above activities, the company also markets "Fordson" tractors which are imported as "knocked down" units from the United Kingdom.

The company has been pursuing a steady developmental plan, aiming at the complete manufacture of V8-type motor vehicles in Australia. The commencement of the final stage of this programme, involving the expenditure of £6 million, has recently been announced. This stage involves the manufacture by Ford of Ford V8 engines, capable of powering both large passenger cars and trucks up to 5-ton load capacity.

GENERAL MOTORS

The General Motors Corporation of America has the controlling interest in General Motors-Holdens Ltd. The head office and principal manufacturing activities of the latter company are located in Melbourne, but all body building is carried out at the company's plant in Adelaide.

In addition to its manufacturing plant in Melbourne and body-building establishment in South Australia, the company has a branch in each State other than Tasmania primarily concerned with the assembly and distribution of General Motors' vehicles of Australian and overseas origin.

The company has produced the "Holden" car and utility, which are designed to suit Australian conditions. These vehicles are substantially of Australian design and content, and imported components are now restricted to those few which are not available from Australian sources. General Motors-Holdens Ltd. has developed its own manufacture of components to a considerable degree, and also buys extensively from other Australian manufacturers.

G.M.-H. Ltd. produces all major castings for the "Holden" engine assembly, e.g., cylinder blocks, cylinder heads, exhaust manifolds. Engine forgings such as crankshafts and camshafts are purchased from other Australian manufacturers, but machining and other finishing operations are carried out by G.M.-H. Ltd. The components for gear box and differential assemblies are mainly produced by the company, but some of the parts for these assemblies are purchased elsewhere in Australia. The "Holden" body is wholly produced by G.M.-H. Ltd., as are most other pressed metal components such as fuel tanks, mufflers, rear-axle housing, etc. Springs, radiators, tyres, tubes, batteries, horns, etc., are obtained from Australian specialist manufacturers. Starter motors, generators, carburettors, speedometers and precision bearings are among the more important items imported.

In addition to the "Holden", the company markets the General Motors range of vehicles, from cars to medium-heavy trucks. It also markets "Vauxhall" cars and "Bedford" commercial vehicles which are imported from the United Kingdom. These vehicles are imported as "knocked down" units and assembled in Australia, using Australian-made components wherever practicable.

The G.M.-H. body-building plant in Adelaide is the largest in Australia. Panels for the "Holden" body are pressed there, as also are other pressed components for the "Holden". The bodies of other vehicles marketed by the company, with the exception of utilities and cabins for trucks, are, in the main, assembled from imported panels, the supply of imported chassis (particularly for U.S.A. cars) being too small to justify panel manufacture.

The company also makes refrigerators. Refrigerator press work is carried out by the company at its New South Wales branch.

INTERNATIONAL HARVESTER

The International Harvester Co. of Australia Pty. Ltd. is wholly owned by the International Harvester Company, Chicago, U.S.A. The head office of the Australian company is in Melbourne and its main manufacturing plants are situated at Geelong and at Dandenong, Victoria.

International Harvester Company has branches in each State (except Tasmania) which are primarily sales offices, but two of these branches are also engaged in assembly work.

In the motor-vehicle field, the company is producing in Australia a range of trucks from 10/15 cwt. utilities up to models of five-tons carrying capacity. It also imports "knocked down" heavier vehicles which are assembled in Australia, using a proportion of Australian-made components. The Australian-produced trucks are substantially of Australian origin, but parts, mainly those which are not readily available in Australia, are imported from the United Kingdom and U.S.A. Components such as crankshafts, camshafts, gear box and differential assemblies are currently being imported.

The company produces some of the castings used in its range of trucks made in Australia. Major cast components such as cylinder blocks and cylinder heads are made at Geelong, and machining is done at Geelong. Other components made at Geelong by the company include small forgings, pressed metal components, etc.

In addition, International Harvester obtains a wide range of components of all types—including cabs, bodies, pistons, engine bearings, engine valves, springs, shock absorbers, radiators, tyres and tubes, batteries, etc.—from manufacturers in New South Wales, Victoria and South Australia.

In addition to its truck production this company is a large producer of farm equipment, wheeled tractors and power units (see Chapter 12, "Machinery, Plant, Equipment, Apparatus, Not Elsewhere Included").

Assemblers

The majority of motor vehicles sold in Australia are assembled from imported components. The vehicles are imported as "knocked down" units, and arrive as a series of sub-assemblies and

parts. Such items as engine, gear-box, rear axle, etc., arrive complete or nearly so. The body is also imported as a "knocked down" unit comprising panels and sub-assemblies, e.g., doors.

Assembly consists of building up the chassis unit, i.e., chassis frame, engine, gear box, etc., welding the body panels into a body shell, spray painting and trimming the body shell, and attaching the body to the chassis. Assemblers as referred to in this section are concerned primarily with chassis-assembly operations, but some also build bodies from imported panels. It is normal practice for most distributors to import vehicles as "knocked down" units, and for them to carry out the necessary work. In recent years, however, imports of "built up" vehicles have been considerable as the unprecedented demand for motor vehicles has been beyond the capacity of Australian assemblers and body builders. Most assemblers build the chassis unit only, and the body is obtained from body builders. This is particularly the case with commercial vehicles, i.e., trucks, utilities and vans.

Australian assemblers of imported vehicles use varying quantities of Australian-made components. Some types of local components fit readily in with the assemblers' requirements, others present technical or economic difficulties. Parts and accessories such as batteries, tyres, horns, springs, shock absorbers, etc., lend themselves readily to incorporation with imported chassis parts. There is a general trend by assemblers to use increasing quantities of Australian-made parts; the supply position, now improved, has been difficult and components which normally would have been obtained from local sources were often imported.

There are more than 60 firms concerned with the assembly of motor-vehicle chassis (and in some instances, bodies) in Australia. These include the four manufacturers previously described and, in addition, several other overseas manufacturers of motor vehicles who have established assembly plants in Australia. Australian distributors of motor vehicles (as distinct from firms controlled by overseas interests) have also, in many instances, established assembly plants, and a considerable volume of assembly operations is carried out by such firms. Most of the overseas companies operate assembly plants in more than one State. Total assembly plants are distributed as follows: New South Wales, 18; Victoria, 18; Queensland, 11; South Australia, 12; Western Australia, 7; Tasmania, 3; total, 69.

The following overseas manufacturers of motor vehicles have established assembly plants in Australia—

NUFFIELD: Nuffield (Australia) Pty. Ltd. is owned and operated by the Nuffield organisation of the United Kingdom. It is concerned with the distribution of the wide Nuffield range of vehicles from "Morris" 8 h.p. cars to 5-ton commercial vehicles, and of "Wolseley", "Riley" and "M.G." cars. The Australian company has an assembly plant in New South Wales, where it assembles a considerable number of the "Morris" cars sold in Australia. Assembly includes the building of bodies from panels imported from the United Kingdom. The vehicles come from the factory in finished condition ready for shipment to Nuffield distributors and dealers. Though this plant commenced operations only in the latter half of 1950, it has rapidly reached peak production and plans to further extend its activities. (A merger between the Nuffield group and Austin in the United Kingdom has been recently announced.)

ROOTES: Rootes Ltd. is a branch of Rootes Ltd. of the United Kingdom, and is responsible for the distribution throughout Australia of the range of vehicles produced by the Rootes group of companies. Vehicles distributed throughout Australia vary from light passenger vehicles to heavy commercial and passenger units. Chassis and body assembly (from imported panels) is carried out in Victoria.

OTHER COMPANIES: Three other companies, **Thornycroft (Australia) Pty. Ltd.**, **Leyland Motors Ltd.**, **Albion Motors (Overseas) Ltd.**, owned by the similarly named United Kingdom companies are distributors of heavy commercial vehicles in Australia. The vehicles are assembled in Australia by the respective companies or their agents. Leyland Motors Ltd., U.K., and Albion Motors Ltd., U.K. recently became associated by an interchange of shares. Leyland Motors U.K. has also bought about a 10 per cent. holding in Commonwealth Engineering Co. Ltd., one of the leading makers in Australia of bodies for public-transport buses.

Body Builders

This section of the Australian industry can be divided into two general groups: Builders of mass-produced bodies (principally passenger-car types); and builders of special or order bodies.

MASS-PRODUCED BODIES: In the first group are three of the companies listed under the previous heading of "Manufacturers": Chrysler Australia Ltd., Ford Motor Company of Australia Pty. Ltd., and General Motors-Holdens Ltd. These three companies account for a very high proportion of bodies of the passenger-car type produced in Australia. Although body panels are pressed by the three companies, each also assembles vehicles solely from imported panels. In most instances, where the body is made from Australian pressings, the front end, i.e., engine bonnet, fenders and radiator grille, is imported.

The assembly of bodies solely from imported panels is carried out by a number of chassis assemblers, and also by two (see below) of the large overseas motor-vehicle manufacturers which own or substantially own body-assembly plants; one of these two manufacturers also carries out some pressing of body panels. Most body builders construct the body (using locally produced or imported panels) and carry out spray painting and trimming. The body is then forwarded

to the chassis-assembly works as a complete unit. The two overseas motor-vehicle manufacturers operating body-building plants in Australia in addition to those previously referred to, are—

Austin: The Austin Motor Company (Australia) Ltd. is owned by the Austin Motor Company, Ltd., England. The Australian company assembles bodies, including truck cabins, for certain models of the "Austin" range of vehicles. Saloon bodies built in Australia are assembled from panels imported from the United Kingdom, but the greater part of the panels for the open-type passenger car are pressed by the company. The company's motor-body building establishment is located in Melbourne, Victoria. (A merger between Austin and the Nuffield group in the United Kingdom has been recently announced.)

Standard: The Standard Motor Company (Australia) Limited has established a factory at Fishermen's Bend, Melbourne. The first phase of operations of this company is the assembling from imported panels of bodies for the "Standard" and "Triumph" passenger car and commercial vehicles. The company was formed by the Standard Motor Co. Ltd., Coventry, England, and Standard Cars Ltd. of Australia. The latter company is the Victorian and New South Wales distributor of "Standard" and "Triumph" vehicles. The formation of a new company, Standard Motor Products Ltd., with a nominal capital of £5 million, was recently announced, to eventually make in Australia "Standard" and "Triumph" cars and "Ferguson" tractors.

SPECIAL OR ORDER BODIES: A wide range of motor vehicle bodies, covering, in the main, commercial-type vehicles, including passenger buses, is made as special or order bodies. Activities in this field are mainly centred in a number of smaller establishments, which either produce bodies to suit the special requirements of the purchasers, or make a standard-type body for which demand is relatively small. In many instances goods-carrying vehicles are sold by the distributor as a cabin and chassis unit and the buyer makes his own arrangements as regards the fitting of a particular body. It is estimated that about 85 firms are concerned with the building of bodies for motor vehicles, but in some instances are primarily devoted to repair work. The larger firms in this group are concerned with the production of passenger-car type vehicles, but the majority of firms (probably over 60) engage in commercial-body building.

Motor-Vehicle and Motor Cycle Parts and Accessories

In 1949-50 there were 133 establishments in Australia classified as mainly or wholly engaged in the manufacture of motor-vehicle and motor-cycle parts and accessories. Of these establishments, 63 each employed up to 10 persons, 47 each employed 11 to 50 persons, 8 each employed 51 to 100 persons, and 15 each employed more than 100 persons. Of this latter group, 11 each employed 101 to 200 persons and 4 each employed 301 to 1,000 persons; the group as a whole employed 3,135 persons out of a total of 5,135 persons employed by this industry. The official statistical classification includes primarily those firms whose major activity is the manufacture of motor-vehicle parts. However, there are many firms engaged in other activities who produce substantial quantities of motor-vehicle parts.

The four major manufacturers of motor vehicles (see also above)—Chrysler Australia Ltd., Ford Manufacturing Company of Australia Pty Ltd., General Motors-Holdens Ltd., and the International Harvester Company of Australia Pty. Ltd.—manufacture either in their own workshops, or through subsidiary companies, or by sub-contract with automotive parts and accessory manufacturers and general-engineering firms, parts and accessories both as initial equipment and as replacement parts.

PARTS AND ACCESSORIES INDUSTRY PROPER: The following are some of the products made mainly by motor-vehicle parts and accessory manufacturers proper, who are generally specialists—

Forgings

GEARS, CROWN WHEELS AND PINIONS: Two companies, both statistically grouped as motor-vehicle parts manufacturers, make gears, crown wheels and pinions for the automotive trade. One other manufacturer is not so grouped.

AXLES: Four major manufacturers—including one above—three of whom are mainly or wholly manufacturers of motor-vehicle parts and accessories.

UNIVERSAL JOINTS: Two major manufacturers—one company making "Hardy-Spicer" universal joints for English and Canadian cars and American trucks; and one company to be in production shortly of "mechanics" joints for American-type cars.

RING GEARS: Two manufacturers—one a major manufacturer of gears; the other a subsidiary of a large motor-spares organisation.

CRANKSHAFTS: One manufacturer—chiefly engaged in the production of a wide range of drop forgings for industry generally, produces crankshafts and other drop forgings for the automotive trade.

VALVES: Two major manufacturers—both wholly or mainly engaged in manufacture of automotive parts; one also makes gears, and the other makes a range of automotive products including axles, universal joints, king pins, shackle bolts, etc.

Springs

LAMINATED: Four major manufacturers—all of whom make an extensive range of springs of all types. None of these companies is wholly or mainly engaged in motor-vehicle accessory manufacture, although one firm does manufacture axles, crown wheels and pinions, differential gears, shackles and king pins, centre bolts, steering components, tools, trailer equipment and general forgings for the automotive trade.

COIL AND OTHER TYPES: About 40 manufacturers. (See "Wireworking", Chapter 12.)

Castings

PISTONS: Three manufacturers of aluminium-alloy pistons; one also makes cast-iron pistons (another subsidiary of the holding company referred to previously) and other automotive parts; the other two firms make pistons as a major activity. One other company makes cast-iron pistons and also makes pump parts and clutch plates.

PISTON RINGS: Five manufacturers, including the three piston manufacturers above. Two make piston rings and cylinder liners as the major activity.

Metal Stampings and Pressings

WHEELS, BUMPER BARS, CLUTCH AND BRAKE PEDALS, PETROL TANKS, TANK, HUB AND RADIATOR CAPS, OIL RETAINERS, DOOR HINGES, GENERAL PRESSINGS AND STAMPINGS: About 20 companies produce metal stampings and pressings for the automotive trade—some as a specialist activity—the majority produce automotive pressings and stampings in association with other similar items for general industry. One large company, associated with a U.K. organisation, makes wheels, bumper bars, clutch and brake pedals and general pressings as a specialist activity. Three other manufacturers, including the Ford Manufacturing Company, make automotive wheels—one of these companies is a major manufacturer of agricultural-machinery parts.

Machined and Repetition Parts and Accessories

KING PINS, SHACKLE BOLTS: Four major manufacturers, three of whom are mainly engaged in motor-vehicle parts manufacture (two make a range of parts, one also makes gears), and a major manufacturer of springs who is not classified as a motor-vehicle parts manufacturer.

FUEL AND OIL PUMP PARTS: Five manufacturers, all of whom are wholly engaged in manufacture of automotive parts.

NUTS, BOLTS, WASHERS, AND NUMEROUS OTHER ITEMS: Several manufacturers of small repetition parts for the automotive trade.

Miscellaneous Processed Parts

RADIATORS: Two major manufacturers—one manufacturing as a major activity, the other company also manufacturing refrigeration coils, evaporators and condensers.

OIL FILTERS: Four manufacturers—one producing as a major activity; one also produces fuel and oil flexible lines and hand tools; one also produces maintenance chemical products; the fourth company is a major manufacturer of lubrication equipment.

MOTOR HORNS: One manufacturer, also making tyre gauges and pneumatic accessories.

SPARK PLUGS: Six manufacturers, five of whom make spark plugs as a major activity; the other makes a wide range of products, including tape and wire recorders, gas hot-water systems, film projectors.

IGNITION PARTS, ARMATURES AND PARTS, CARBON BRUSHES, IGNITION COILS, SWITCHES, DISTRIBUTOR PARTS, RELAYS, WINDSCREEN WIPERS, GENERAL ELECTRICAL PARTS, GENERATOR PARTS: One major manufacturer makes an extensive range mainly for the automotive field. One company makes a limited number of items in association with other automotive parts. One company makes windscreen wipers and also makes cigarette lighters. One company, a subsidiary of General Motors-Holdens Ltd., makes electrical equipment for vehicles marketed by G.M.-H. Ltd. Two companies not classified as motor-vehicle parts manufacturers make certain electrical components.

GASKETS: Three major manufacturers make a comprehensive range of gaskets as a major activity.

PARTS AND ACCESSORIES FROM OTHER INDUSTRIES: The following are some of the products made by other manufacturers of automotive parts and equipment, the manufacture of which forms only a part of their industrial activities—

Rubber Components: TYRES, TIE-ROD ENDS, ENGINE MOUNTINGS, SHOCK-ABSORBER PARTS, MOULDED HOSES, SPRING SHACKLES, PEDAL PADS, VULCANISING OUTFITS,

AND OTHER RUBBER SUNDRIES. Several companies make a range of small rubber components for the automotive industry, but are not statistically grouped under this category. For detailed treatment see Chapter 8, "Rubber Products".

Plastic Components: DOOR HANDLES, ASH TRAYS, AND SMALL ACCESSORY ITEMS. See Chapter 7, "Plastics Products".

Glassware: WINDSCREENS, SIDE SCREENS. One major manufacturer of toughened and laminated types, at two establishments, and one smaller manufacturer, making the laminated type. For detailed treatment see Chapter 2, "Products of Crude and Treated Non-metallic Minerals".

Mechanical Repairers

This section of the industry is widely established throughout Australia and comprises about 4,650 establishments. There is a small number of large workshops, mainly in the capital cities, which are equipped to carry out major mechanical overhauls. The motor-vehicle distributors, and most of the wholesalers of replacement parts, have established workshops in the capital cities and some of the larger country towns. There is some specialisation in particular aspects of mechanical repair work, e.g., electrical, brakes, radiator, etc. The bulk of this section of the industry is, however, located in the small workshops that are usually part of garages and filling stations.

Body Repairers

It is estimated that about 370 establishments are concerned with body-repair work. Most of these establishments are small and carry out a variety of work including welding, panel beating, ducoing and trimming. In some instances repair work is carried out as a minor activity of body building, and in other instances repair work predominates with the building of an occasional special body.

MOTOR CYCLES

ASSEMBLY: There are about 30 companies, practically all of which are the authorised State distributors for the makes concerned. Motor cycles, other than a small quantity of auto-cycles with imported engines, are not made in Australia, and are imported in a condition requiring little assembly work.

SIDE-CAR CHASSIS AND BODY MANUFACTURE, AND REPAIR: These activities are carried out mainly by three companies. The principal manufacturer is a specialist who makes the chassis as well as body; a foundry is operated, and all components other than bearings, wheel rims and spokes are made. The other two makers assemble the chassis, but make the body; one is a specialist, the other also makes cycle parts and accessories. Repair of side-car units is carried out mainly by side-car makers and by motor-cycle repair workshops.

MECHANICAL REPAIRS: There are about 50 establishments wholly or mainly concerned with motor-cycle repairs, servicing, adjustment, the principal workshops being those operated by State distributors of motor cycles. Motor-vehicle repair workshops carry out motor-cycle repairs only to a minor extent.

BICYCLES AND PARTS

In 1949-50 there were 116 establishments wholly or partly engaged in building, maintenance and repair of bicycles and in the manufacture of bicycle parts, as compared with 118 establishments in 1948-49. Of these 118 establishments, 90 each employed up to 10 persons, 11 each from 11 to 20 persons, 10 each from 21 to 50 persons, 5 each from 51 to 100 persons, and 2 each more than 100 persons; the latter 2 establishments collectively employed 303 persons out of an industry total of 1,374 persons. The more-than-20 employees group employed 929 persons, and the not-more-than-20 group employed 445 persons.

BICYCLE MANUFACTURE: Pedal-type cycles are made mainly by eight firms. These are as follows: Allied Bruce Small Ltd., the largest single manufacturer in Australia, also operating seven subsidiary organisations mainly concerned with the manufacture of cycle parts, and maintaining a marketing organisation with branches in each capital city and in the larger provincial towns. — Finlay Bros. Pty. Ltd., also engaged in the assembly of motor cycles, manufacture some cycle components and assemble complete cycles. — A. G. Healing Ltd., chiefly concerned with the manufacture of domestic radio receivers, refrigerators, vacuum cleaners, automotive maintenance equipment, plating equipment, machine tools and storage batteries, also assemble cycles. — Of the five other manufacturers, three assemble cycles and manufacture certain components as a major activity; one company is a retailer of automotive spare parts;

the remaining company manufactures a range of sporting goods. — Numerous traders and small workshops purchase the necessary components, either imported or locally manufactured, and assemble.

BICYCLE PARTS MANUFACTURE: Precision tubing for the manufacture of bicycle frames is produced exclusively by an associate company of the B.H.P. group, British Tube Mills (Aust.) Ltd.; the company also has capacity to produce head fittings, bottom bracket fittings, chain-wheel, cranks and wheel rims. — Bicycle saddles were made by three companies specialising mainly in their manufacture. Remote controls (of the Bowden type) were made by one company, which also supplied cable and outside casings to other firms for assembly; controls made by this firm were supplied for use on bicycles, motor-cycles, tractors, lawnmowers and aircraft. — Bicycle spokes are made by two firms (see "Wireworking", Chapter 12, for details). (The manufacture of bicycle parts in Australia declined considerably and rapidly when imported parts became plentiful in the late post-war period.)

BICYCLE REPAIR: Repairs to bicycles are carried out mostly by those retail traders, conducting bicycle shops, who have been trained in bicycle building; most large shopping centres throughout Australia have such a shop, often several. Few of such shops make parts, and would not be recorded statistically as cycle-making establishments unless circumstances qualify the establishment as a factory establishment for statistical purposes (see Appendix IV).

HORSE-DRAWN VEHICLES

In 1949-50 there were 128 establishments wholly or mainly engaged in the manufacture and/or repair of horse-drawn vehicles, as compared with 131 establishments in 1948-49. Of these 131 establishments, 127 each employed ten persons or less, and collectively employed 417 persons out of the industry total of 478 persons; of the four remaining establishments, three collectively employed 36 persons, and one employed 25 persons. The principal manufacturer produces pneumatic-tyred bakers' deliveries, milk floats and lorries (for which demand is greatest), trotting vehicles, gigs to order, and does a certain amount of motor-body building under contract. The industry is characterised by a large number of small firms, which carry on some other activity generally associated with coach-building. Quite a number of the smaller builders and/or repairers are located in country centres. In recent years, with supply considerably in excess of demand, the industry has tended to move away from the city centres to rural areas and provincial centres where there is still a small demand for certain types of vehicles. (FARRIERS, mainly specialists as one-man businesses, are scattered throughout the metropolitan areas of capital cities to serve, principally, food purveyors, using horse-drawn transport, and to shoe racehorses and riding hacks. In country areas, farriery is usually associated with blacksmithing.)

RAILWAYS, LOCOMOTIVES, RAILWAY ROLLING STOCK, TRAMCARS

There were 141 establishments wholly or mainly engaged in manufacture and/or repair of railway or tramway equipment in 1949-50. In 1948-49, there were 137 establishments, 128 of which were government (including municipal) owned, and 9 were non-government. Of these 137 establishments, 28 each employed up to 10 persons, 15 each from 11 to 20 persons, 32 each from 21 to 50 persons, 21 each from 51 to 100 persons, and 41 each more than 100 persons. The latter 41 establishments collectively employed 37,063 persons out of the industry total of 40,012 persons; 4 of the 41 establishments were non-government establishments, and collectively employed 1,791 persons.

PERMANENT WAY, WORKS, ETC.: Railway and tramway authorities usually construct permanent way and other works themselves; however, large projects are sometimes let to private contractors, although plate laying is always carried out by the authorities.

LOCOMOTIVES

Steam Locomotives of both passenger and freight types are made by the railway administrations of the various States in their own workshops and by some large private companies, all of which operate extensive engineering workshops. Of these, Clyde Industries Limited, Granville, N.S.W., also constructs various types of rolling stock and tramcars, and also carries out bridge construction and similar types of structural work, general engineering work of every description including production machining and fabricating of castings and forgings, and manufacture of storage batteries. — Walkers Ltd., Maryborough and Mackay, Qld., builds ships, bridges and similar structural work and manufactures a wide range of equipment, including diesel engines, sugar mills, mining and general machinery; it also does steel, iron and brass founding, boiler making, copper smithing and forging. — Perry Engineering Co. Ltd., Mile End, S.A., carries out heavy structural and mechanical engineering, builds small vessels such as tugs, and is an important manufacturer of cable-ways, cranes and winches, besides a range of equipment including bridges, heavy hydraulic presses, boilers, condensers, oil engines, foundry equipment, concrete mixers, crushers, excavators and mining machinery. — Morison & Bearby Pty. Ltd., Newcastle, N.S.W., also manufactures engines and boilers, cranes, grabs, metallurgical and mining equipment, pumping machines, mine skips, trucks and freight wagons, steam plant, valves, hydrants, water pipes and pumps, sewage-treatment plant, filters,

and does general engineering of all types as well as iron and brass founding, boiler making, copper smithing and forging. — Evans Deakin & Co. Ltd. of Brisbane, Qld., carries out locomotive repairs for the Queensland Railways, and builds goods wagons.

The Bundaberg Foundry Co. Ltd., Bundaberg, Qld., makes narrow-gauge locomotives for the sugar industry, under licence from an English company. It also carries out foundry work, general engineering, rolling stock repairs and makes sugar and mining machinery. — Perry Engineering Co. Ltd., Mile End, S.A. (see also above) has recently made narrow-gauge locomotives for the sugar industry.

Other heavy engineering shops have in the past made locomotives, but are not at present so engaged. If the activity were to become attractive to them, they could probably resume it at fairly short notice.

Diesel and Diesel-electric Locomotives: An agreement between Clyde Industries Limited and the General Motors Corporation of America enables the former to make a well-known American type of diesel-electric locomotive under licence from the latter, some components, including motors and electrical gear, being supplied from the United States. — The South Australian Railways is also building this type of locomotive, using imported power units. — Diesel-electric locomotive underframes are made at several establishments including a Commonwealth Government ordnance factory. (Locomotives made by each of the two manufacturers are already in service.)

Diesel and Diesel-electric Railcars, which have gained considerable importance in the Australian Railway systems, are made by railway workshops. The bodies for some of these have been made by Martin & King Limited, Malvern, Vic., a manufacturer of standard and custom bodies for passenger and commercial motor vehicles. — The Commonwealth Engineering Co. Ltd., which has works at Sydney and Brisbane, is making rail cars for Queensland lines.

Electric Suburban Passenger Coaches and freight locomotives are built in Australia, although some electrical gear is imported. (The N.S.W. Railways make traction motors for their own use. The Australian General Electric Pty. Ltd., Sydney, N.S.W., makes traction motors. — The English Electric Co. Ltd. is expediting plans to make some items of diesel and diesel-electric traction equipment at its works at Brisbane, Qld.)

RAILWAY ROLLING STOCK

Passenger Vehicles are made by railway authorities in their own workshops, and by several private firms. Commonwealth Engineering Co. Ltd., Sydney and Brisbane, is a large manufacturer of passenger and freight vehicles and tramcars, and is the largest manufacturer of motor bus bodies in Australia. It also assembles imported Leyland chassis. — Clyde Industries Ltd. make passenger and freight rolling stock and locomotives, and are large constructional engineers. — Tulloch Ltd. make all types of rolling stock, mine cars and skips, metal tiles and building components, shovels and garden tools. — Ritchie Bros. are almost exclusively engaged on passenger and freight rolling stock for the New South Wales railways. (These three firms are all located in the Sydney area.) — Martin & King Ltd., Melbourne, motor and bus body builders, make bodies for diesel-electric rail cars and assemble imported goods trucks.

Goods Vehicles are made by railway authorities in their own workshops, and by a number of firms in different States. Besides Commonwealth Engineering Ltd., Clyde Industries Ltd., Tullochs Ltd. and Ritchie Bros., there are, in the Sydney area, A. E. Goodwin Ltd., who also make earth moving equipment, mobile cranes, boilers, pressure vessels, stoves, and carry out general engineering and shipbuilding; in Newcastle, A. Goninan & Co. Ltd., making also mining and other machinery, boilers, gears, bridge and other structural and general engineering products, and Morison & Bearby Ltd., making cranes and hoists, presses, pumps, compressors, and other machinery, structural and general engineers. — In Queensland, beside Commonwealth Engineering Co. Ltd., Evans Deakin & Co. Ltd. manufactures goods wagons. — In Western Australia, Tomlinson Steel Pty. Ltd., of Perth, have made goods stock for the State's railway system; Hume Steel Ltd., also of Perth, have made goods wagons for Ceylon.

Many firms are engaged in supplying components for rolling stock, of which Bradford Kendall Ltd., of Sydney, a founding firm with much experience, has specialised in frames and bogies, as well as assembling trucks from imported components. This latter activity is shared by several of the rolling stock constructing firms, as the majority of goods wagons are imported in a "knocked-down" condition. Martin & King Ltd. has already been mentioned in this regard.

TRAMCARS AND TROLLEY BUSES

Tramcars (excluding motors and some other electrical gear) are made by various State operating authorities in their own workshops. Of the private firms in this field, Commonwealth Engineering Co. Ltd. and Clyde Industries Ltd. have fulfilled substantial orders; the former has also supplied several Australian cities with Trolley Buses. — The Brisbane firm of Charles Hope Ltd., makers of electric refrigerators, stoves, and of motor bodies, have built trolley bus bodies of aluminium for local service. — J. A. Lawton & Sons Ltd., of Adelaide, builders of motor bodies, materials handling equipment and general engineers, have also made trolley bus bodies for Adelaide and Launceston.

AIRCRAFT, PARTS, ACCESSORIES

In 1949-50 there were 49 establishments and in 1948-49 45 establishments wholly or mainly engaged in construction and maintenance of aircraft and/or manufacture of parts and accessories. Of the 45 establishments, 14 each employed up to 10 persons, 2 each from 11 to 20 persons, 6 each from 21 to 50 persons, 6 each from 51 to 100 persons, and 17 each more than 100 persons; the latter 17 establishments collectively employed 10,036 persons out of the industry total of 10,799 persons.

AIRCRAFT AND ENGINES

Complete aircraft are made in Australia by one company only—Commonwealth Aircraft Corporation Pty. Ltd. Both jet-engined and piston-engined aircraft are made. This company is owned by a group of leading Australian industrial organisations, i.e., steel, silver-lead mining, chemical and shipping industries, together with a United Kingdom Company (Rolls-Royce Ltd., one of the world's leaders in aircraft engines, and in high-quality motor-car manufacture).

One other company—the de Havilland Aircraft Pty. Ltd., a subsidiary of de Havilland Aircraft Co. Ltd., a leading United Kingdom manufacturer—is engaged in the production of aircraft frames for jet-engined fighter aircraft, the engines for which are made in Australia, and frames for piston-engined light passenger-transport planes, the engines for which are imported. The company is the only manufacturer of propellers in Australia and in addition to its own activities in that field it also operates a Commonwealth Government owned annexe for propeller manufacture and repair.

Commonwealth Government Aircraft Factories, through the Division of Aircraft Production, Department of Defence Production, produce aircraft frames for bomber aircraft, engines for which are also made in Australia.

Both reciprocating and jet engines are made (utilising a percentage of imported components) by C.A.C. Pty. Ltd., which operates two factories, one for complete aircraft at Fishermen's Bend, Vic., on its own behalf, and the other for engines, at Lidcombe, N.S.W., on behalf of the Commonwealth Government.

AIRCRAFT PARTS AND ACCESSORIES

Aircraft parts and accessories are made chiefly by about 50 establishments, including the three main aircraft-manufacturing factories, which make parts and accessories both as initial equipment and as replacement parts for their own aircraft. The remainder either make certain simple components as replacement parts for civil aircraft of British or American manufacture, or are sub-contractors to major aircraft-manufacturing establishments for the production of components and/or assemblies as initial equipment and as replacement parts for defence aircraft. Of these latter companies, few specialise in the manufacture of aircraft parts and accessories such as aero-dynamic equipment, sparkplugs, airframes, and special components, while the remainder associate such manufacture with other activities such as motor-vehicle parts and accessory manufacture, rubber components, general precision and repetition engineering, etc.

In recent years, branches of overseas aircraft component manufacturing organisations have been established in Australia. These establishments have either begun manufacture, or will manufacture in the near future, aircraft components in Australia. Amongst these firms are S. Smith and Sons (Aust.) Pty. Ltd., manufacturers of aircraft instruments; Lucas-Rotax (Aust.) Pty. Ltd., manufacturers of starters for turbine jet engines; Dunlop Rubber Australia Ltd., who have established an engineering branch, make electrical, hydraulic and pneumatic equipment for aircraft; Chrysler Australia Ltd., who have established an aircraft division to fabricate sheet metal work for "Canberra" jet bombers and other aircraft; the Bristol Aeroplane Company of Australia; and Bendix-Tecnico Pty. Ltd., making aircraft accessories, particularly electrical.

MAINTENANCE

The maintenance of defence aircraft is chiefly carried out by the aircraft manufacturers and Air Force personnel at various operational stations throughout the Commonwealth. The maintenance of civil aircraft is carried out by the De Havilland Aircraft Pty. Ltd.; in the workshops of the major Australian airlines—Trans-Australia Airlines (Commonwealth owned organisation), the Australian National Airways Ltd. (associated with shipping companies), Ansett Airways Ltd. (associated with an intensive network of road transport industries); five other Australian airlines, two of which operate in New South Wales, one each in Victoria, South Australia and Western Australia, respectively; and two overseas international airlines, Qantas Empire Airways and British Commonwealth Pacific Airlines Ltd. In addition there are several small firms which carry out minor general repairs. The repair and maintenance of naval aircraft is carried out by Fairey Aviation Co. of A'asia Pty. Ltd., Bankstown, N.S.W.

SHIP AND BOAT BUILDING AND REPAIRING, MARINE ENGINEERING

In 1949-50 there were 212 establishments, and in 1948-49 201 establishments, wholly or mainly engaged in manufacture and/or repair, including docking or slipping, of ships, boats, and/or in

marine engineering. The employment-size groups and total employment of these establishments in 1948-49 were as follows—

ESTABLISHMENT SIZE:	Up to 10 Persons		11-20 Persons		21-50 Persons		51-100 Persons		Over 100 Persons		Total for Activity	
	Est.	Pers.	Est.	Pers.	Est.	Pers.	Est.	Pers.	Est.	Pers.	Est.	Pers.
Government	1	9	—	—	—	—	3	207	6	4,605	10	4,821
Other (including municipal)	113	477	17	270	26	835	15	1,071	20	8,690	191	11,343
Totals	114	486	17	270	26	835	18	1,278	26	13,295	201	16,164

This statement of structure of the industries and activities of this group is set out in the following sequence—

Shipbuilding (including Fitting-Out) and Ship-Engine Building—

Introduction, including comment on manufacture of boilers, engineroom auxiliary plant and deck-plant

Combined Building of Ships and Ship Engines—

Non-government Owned
Government Owned, but Leased
Government Owned and Operated

Shipbuilding (but not Engines)—

Non-government Owned
Government Owned and Operated

Ship-Engine Building (but not Shipbuilding)—

Government Owned and Operated
Government Owned, but Leased

Additional Capacity for Building of Ships and Ship Engines—

Shipbuilding
Ship-Engine Building

Dry Docking, Slipping, Repair of Ships, Lifting Facilities

Smallcraft and Boat Building and Repair

SHIPBUILDING (INCLUDING FITTING-OUT) AND SHIP-ENGINE BUILDING

Nine organisations have practically all the regular capacity in Australia for shipbuilding and ship-engine building.

Five of the nine organisations combine shipbuilding and ship-engine building. (However, the engines built since 1939 have not been necessarily only for ships built by the same organisation. All have made engines for ships built at other shipyards; one (Walker's) has made the engines for all ships built by it; another (Cockatoo Docks) all engines except for one ship; and a third (Mort's) for most of the ships built by it. Engines have also been imported—see Part Two of this Chapter for details.)

Three of the nine organisations build ships, but do not build ship engines.

One of the nine organisations builds ship engines, but does not build ships.

In addition there are seven other large engineering establishments that have built ship engines in recent years (mainly during the 1939-45 War), and there are establishments that could enter into ship-engine building or shipbuilding (particularly of small ships), or both.

The extent to which there is participation by the Commonwealth Government and State Governments in ownership and operation of shipyards and ship-engine works is shown in the detail provided below concerning the structure of the industry.

All the shipbuilders do the fitting-out of ships built by them, so the term "shipbuilding" as used in this study includes the fitting-out activity, much of which is usually done before the ship is launched. Usually the wharf for final fitting is at or close to the shipyard.

The term "ship" (for this study) includes harbour and sea-going tugs, harbour and sea-going dredges, where such small vessels are built in a shipyard building the larger ships.

All the shipbuilders do ship-repair work. For those with docks it is a major activity, but for most of the others it is a minor activity.

All the ship-engine builders do repair and/or rebuilding work, and to a limited extent make auxiliary equipment.

"Lloyds Register of Shipping" for 1951 lists 38 manufacturers in Australia of "machinery and boilers" for ships. Comment on manufacturers of ship engines is set out in detail later in this Part. Water-tube boilers for ships are made in Australia by four organisations—Babcock & Wilcox of Australia Pty. Ltd., John Thompson Combustion Pty. Ltd., Cockatoo Docks & Engineering Co. Pty. Ltd., and N.S.W. State Dockyard. Babcock & Wilcox, a subsidiary company of Babcock & Wilcox Ltd., U.K., is the principal maker of water-tube boilers installed

and being installed in steam-driven merchant ships built in Australia; all of the boiler is made in Australia other than the staggered headers, boiler-drum ends, superheater boxes and mud-drum boxes, which are imported from the parent company. John Thompson Combustion, a subsidiary company of John Thompson Ltd., U.K., made six boilers of Australian Shipbuilding Board design (sometimes called the "Mac" boiler) for one class ("D") of cargo ships in Australia. Cockatoo Docks is principally concerned (as far as ship boilers are concerned) with boilers for naval ships and (with the aid of sub-contractors) built all the boilers ("Yarrow" type) except twelve for all the naval vessels built in Australia during the 1939-45 War; it also built two "Babcock & Wilcox" and fourteen "A.S.B." water-tube boilers, for merchant ships. The N.S.W. State Dockyard has made a few small water-tube boilers, and is importing water-tube boilers for dredges now being made. Scotch boilers are made by a few of the shipbuilders and by a few boilermakers associated with ship-repair work, and are also imported. Condensers are made by shipbuilders, some boilermakers, and by a few general-engineering companies. Ship propellers are mainly made by Cockatoo Docks and Mort's Dock, and propeller shafts mainly by Australian Iron & Steel Ltd., but other foundries and forges have made propellers and shafts. Engine-room auxiliary plant for merchant and naval ships is principally made in Australia by about four companies, one of which, associated with leading U.K. manufacturers of steam-raising auxiliary plant for ships, power-houses, etc., has become prominent—Ferrier, Dickinson & Weir-Drysdale Ltd., owned by Federated British Engineers (N.S.W.) Ltd.; this company has begun making electric-driven deck plant, which is usually imported. Steam-driven winches for cargo-handling are made in Australia, and various items of equipment generally, including engine-telegraph equipment. Subcontracting of various fitting-out activities, such as electrical wiring, furnishings, making of ship's boats, etc., is a common practice, but some shipyards are equipped for such specialist work, including cabin woodwork and furnishings.

Shipbuilding in Australia since 1939 (when a renaissance occurred after about fifteen years' dormancy) has been directed to coastal cargo ships, naval ships to destroyer size, and to tugs, dredges, powered lighters and similar small ships. Only one passenger ship (37 passengers, but with considerable cargo space, including refrigerated) has been built in recent years and for many years. The Australian shipbuilding and ship-engine industry, to maintain its status, depends almost entirely upon a continuing and adequate merchant and naval shipbuilding programme by the Commonwealth Government. The authorities administering the Commonwealth Government's programme of shipbuilding are the Department of Shipping and Transport (of which the Australian Shipbuilding Board and Australian Shipping Board are parts) and the Department of the Navy (of which the Naval Board is a part). (See Part Two of this Chapter for details.)

The classes of ships built or being built to order of the Australian Shipbuilding Board are, in order of deadweight-tonnage size —

A.S.B. 10,000-d.w.ton bulk-carrier class (in two types—steamship and motor).

B.H.P. 10,000-d.w.ton ore-carrier (in one type—steam-turbine—this type being known as the "Whyalla" class). (In order to qualify for the Commonwealth Government help in equalising shipbuilding costs in Australia with overseas costs, these four ore-carriers have been ordered by The B.H.P. Co. Ltd. through the Australian Shipbuilding Board, which placed the building order with The B.H.P. Whyalla Shipyard; on completion of each ship The B.H.P. Co. Ltd. will buy it from the Commonwealth.)

8,500-d.w. ton "A" class (in one type—steam-reciprocating, with exhaust turbine—for general cargo).

7,000 to 6,000-d.w.ton "B" class (in three types—motor-collier of 7,000 tons; motor, of about 6,400 tons, for general cargo; and steam-reciprocating, with exhaust turbine, of about 6,400 tons, for general cargo).

A.S.B. 4,750-d.w.ton collier (in one type—steam-reciprocating).

3,030-d.w.ton "U/S" class (in one type—motor).

3,000-d.w.ton "D/A" class (in one type—motor—for general cargo, with intended variations such as cattle decks).

2,975 to 2,475-d.w.ton "D" class (in two types—steam-reciprocating, of 2,975 tons, for general cargo; motor, of 2,475 tons, for passengers and cargo).

2,100-d.w.ton collier (in one type—motor, this type being called the "M/M" class).

633-d.w.ton "E" class (in one type—motor—for general cargo).

The classes of ships built by The Broken Hill Proprietary Co. Ltd. on its own order for its own use are as follows (see also B.H.P. 10,000-d.w.ton ore-carrier, above)—

12,500-d.w.ton ore-carrier (in one type—steam-turbine—this type being known as the "Yampi" class).

8,030-d.w.ton ore-carrier (in one type—steam-reciprocating—this type being known as the "Chieftain" class).

(All of the above merchant ships are described in further detail in Part Two of this Chapter.)

All naval ships built in Australia are to the specifications and order of the Naval Board. Types of naval ships built in Australia since the beginning of the 1939-45 War are destroyers of three classes, frigate of one class, sloop of one class, corvette (now called "fleet minesweeper") of one class, boom-defence ship of one class, and various tugs (and also a wide variety of smallcraft, including ocean-going). The tonnage of all naval ships included below is stated as "standard displacement".

Combined Building of Ships and Ship Engines

NON-GOVERNMENT OWNED:

The Broken Hill Proprietary Co. Ltd., Newcastle, N.S.W., and Whyalla, S.A., is mainly a producer of iron, steel, steel shapes and steel products, and it operates as an integral and essential part of such activity the largest non-government coastal shipping line in Australia. (See Chapter 9 for details of the company, and see also below for mention of Australian Iron & Steel Ltd., subsidiary company of The B.H.P. Co. Ltd., as a ship-engine builder.) The B.H.P. shipyard at Whyalla is the largest building yard in Australia, and has five building berths, each of 620 feet, maximum 22,500 d.w. tons. (The company has no dock or slip for ship repair or cleaning.)

The first ship built at the Whyalla yard was launched in 1941. Ships completed (by May, 1952) total 21, the largest of which are three of the 12,500-d.w.ton "Yampi" class ore-carrier (steam-turbine); the fourth ship of this class was launched in April, 1952, and is now being fitted. The other ships completed are four 650- to 790-s.d.ton corvettes (steam-reciprocating), five 8,500-d.w.ton "A" class general-cargo ships (steam-reciprocating), four 6,400-d.w.ton "B" class general-cargo ships (steam-reciprocating), two 8,030-d.w.ton "Chieftain" class ore-carriers (steam-reciprocating), and three 2,975-d.w.ton "D" class general-cargo ships (steam-reciprocating). The yard is building currently, two of the four 10,000-d.w.ton ore-carriers (steam-turbine) of B.H.P. design, to be built at the yard for the company's own use; and two 4,750-d.w.ton colliers (steam-reciprocating). The yard has yet to lay down two 10,000-d.w.ton ore-carriers (steam-turbine) of its own design; and four 10,000-d.w.ton bulk-carriers of Australian Shipbuilding Board design (three of these ships will be steamships and the other a motorship).

The B.H.P. group has built, since 1939, four 2,650-h.p. triple-expansion engines (by A.I. & S. Ltd.) for four "A" class general-cargo ships, two 2,800-h.p. quadruple-expansion engines (by The B.H.P., Newcastle) for its own two "Chieftain" class ore-carriers, and three 5,500-h.p. sets of turbines (by The B.H.P., Newcastle) for three of the four ships of its own "Yampi" class—the set of turbines for the first ship launched was imported. (See also Part Two of this Chapter concerning turbine manufacture in Australia.) The B.H.P. group's facilities used for manufacture of ship engines were at the steel works, foundries and forge shops of Commonwealth Steel Co. Ltd., Newcastle, the foundries and engineering shops at The B.H.P. Newcastle works and A.I. & S. Port Kembla works, and the recently-completed gear-cutting and turbine-blading shops at The B.H.P. Whyalla works. (When the ship-engine works now being planned for Whyalla is completed, engine-building activities of The B.H.P. Co. Ltd. will be centered there, the forgings and casting of large size, and some other requirements (according to convenience) being provided by other units of The B.H.P. Co. Ltd. and the B.H.P. group generally. The company does not make steam-raising equipment.) — Each of the two 4,750-ton colliers will have a 1,850-h.p. self-oiling double-compound engine; both engines are already built, one at State Dockyard, N.S.W., the other at Cockatoo Dockyard. Of the four sets of turbines required for the four B.H.P. 10,000-ton ore-carriers, one set of complete geared turbines and two further sets of gears are to be made by The B.H.P. Co. Ltd., and one set of completed geared turbines and two sets of ungeared turbines will be imported. If the Australian Shipbuilding Board decides to power with turbines the three steamships of its 10,000-ton bulk-carrier class (all three to be built by The B.H.P. Co. Ltd.), it is likely that the first set of turbines, complete with gears will be imported, and it is not unlikely that The B.H.P. Co. Ltd. would build the other two sets of turbines and gears; the fourth bulk-carrier to be built by The B.H.P. Co. Ltd. will be a motor-ship and will have a "Doxford" 3,500-h.p. oil-engine to be built by The Commonwealth Marine Engine Works.

Mort's Dock & Engineering Co. Ltd., Sydney, N.S.W., shipbuilder, ship docker, ship repairer, marine and general engineer, is mainly concerned with ship repair and re-fitting, etc. (for which it is one of the largest companies in Australia), general engineering and fabricated steel-pipe manufacture. The company was founded in 1854. It has four building berths, two of 450 feet, two of 320 feet, maximum 10,000-d.w. tons. (The company owns and operates two graving docks, two small floating docks, and three hauling-up slips for ships.) The company in the past has built large steam-ferries and dredges. It also makes ship propellers.

During the 1939-45 War the company built four 1,445-s.d.ton frigates (steam-reciprocating) and fourteen 650- to 790-s.d.ton corvettes (steam-reciprocating); three 100-ft. tugs (with imported diesel-engine of 440-b.h.p.); a 1,000-ton floating dock; two 1,200-ton lighters; and fabricated hull material for two 8,500-d.w.ton "A" class general-cargo ships built at The B.H.P. Shipyard, Whyalla. Considerable wartime repairs and alterations to merchant and naval ships, and conversions of merchant ships to and from war service, were carried out. Currently the company is building two 6,400-d.w.ton "B" class general-cargo ships (motor); an ocean-going tug (steam-reciprocating, and with Kort nozzle—see Cockatoo Docks, later) fitted for salvage work and fire fighting, for Melbourne tug-owners; a grab hopper-dredge (steam-reciprocating) of 300-tons hopper capacity for the Maritime Services Board, N.S.W.; a dredge of 250-tons hopper capacity (with an imported diesel-engine of 350-b.h.p.) for the W.A. State Government; a 650-ton capacity hopper-barge, and pontoons and lighters.

Throughout the war years and early post-war years Mort's built eight 2,750-h.p. triple-expansion engines for use in pairs in the four frigates built by the company; twenty 900-h.p. to 1,000-h.p. triple-expansion engines for use in pairs in ten of the fourteen corvettes built by the company; and two 2,650-h.p. triple-expansion engines for two 8,500-d.w.ton "A" class general-cargo ships built at other yards. The company is at present building a triple-expansion engine of 1,200 h.p. for the tug being built for Melbourne tug owners; and two triple-expansion engines each of 425-h.p. for the Maritime Services Board hopper-dredge being built by the company. Steam-ton "B" class ships being built by the company will be powered with a 2,800-h.p. "Doxford" oil-engine of Commonwealth Marine Engine Works manufacture.

Walkers Limited, Maryborough (and Mackay), Qld., general, railways and marine engineer, and shipbuilder, is mainly concerned with general and railways engineering. The company was founded in 1863. It has two building berths, each 320 feet, maximum 2,000-d.w.tons. (The company has no dock, slip, etc., for repair of ships.) The company had built ships in past years, mainly in two periods, 1882 to 1887, and 1918 to 1923, two cargo-ships of 6,200-d.w.tons being built in the latter period as part of a Commonwealth Government shipbuilding programme of that time.

During the 1939-45 War and into the early post-war period the company built three 1,445-s.d.ton frigates (steam-reciprocating), seven 650- to 790-s.d.ton corvettes (steam-reciprocating), and three 93-ft. naval tugs (each fitted with an imported diesel engine). In the latter post-war

period the company built five 633-d.w.ton "E" class general-cargo ships (motor). Currently the company is fitting an ocean-going sterntrailing-suction hopper-dredge it launched in late 1951, and has an order to build one 773-s.d. ton naval boom-working ship, including engine.

During the war the company made eight 2,750-h.p. triple-expansion engines for use in pairs in frigates, three of which it built itself; and thirty-two 900-h.p. to 1,000-h.p. triple-expansion engines for use in pairs in corvettes, seven of which it built itself. A considerable quantity of auxiliary equipment for such naval ships was also made. After the war the company built five 540-h.p. "Mirrlees"-type diesel engines for the five "E" class ships built by the company, and it is currently (1952) building four 720-h.p. "Mirrlees"-type diesel engines for use in pairs in two twin-screw 3,000-d.w.ton "D/A" class general-cargo ships being built at the State Dockyard, N.S.W.; two of the engines have been completed. The company is to make one 850-h.p. triple-expansion engine for a naval boom-defence ship to be built by it. Four 300-h.p. triple-expansion engines for the suction-dredge currently being fitted are being made at the N.S.W. State Dockyard.

GOVERNMENT OWNED, BUT LEASED:

Cockatoo Island Dockyard. Sydney, N.S.W., is owned by the Commonwealth of Australia and has been leased since 1933 to **Cockatoo Docks & Engineering Co. Pty. Ltd.** In 1947 the company became a subsidiary company of Vickers-Armstrong Ltd., U.K., and in 1948 of Vickers Ltd., U.K. parent company of Vickers-Armstrong Ltd. The dockyard had its origin in 1858 as a State dockyard. (Part of the island, which is in Sydney Harbour, was a penal establishment from prior to the dockyard being established until early this century.) When the Royal Australian Navy was established, in 1913, the Commonwealth of Australia took over the dockyard (and the Island) from the State. During the 1914-18 War and for a few years afterwards the dockyard built several ships and their engines, including two light cruisers, three torpedo-boat destroyers, a seaplane carrier, two cargo ships of 5,600 and 6,200-d.w.tons, four lightships, one naval collier of about 6,800-d.w.tons, one naval coal-storage vessel of about 5,250-d.w.tons, three passenger-carrying lighthouse ships of 1,000-1,400 tons gross, two bucket dredgers, one passenger ferry, and two twin-screw refrigerated ships of about 12,000-d.w.tons, the largest ships built in Australia to that time; the four 3,500-h.p. quadruple-expansion engines built by Cockatoo for those two twin-screw ships are the largest reciprocating steam-engines ever built in Australia. In the period 1933-39 the Dockyard built two 1,060-s.d.ton sloops and one 530-ton boom-defence ship for the Royal Australian Navy, one patrol ship for the Commonwealth Government, three steam-driven and two diesel-driven tugs, several large barges and various smallcraft. The establishment since 1913 has been and remains primarily concerned with naval work when such is available. However, the dockyard other than in war years has been notably engaged in merchant-marine work and general engineering; at present it is mainly concerned with naval work on the building side, but is considerably engaged in docking and repair work for merchant ships, and its general-engineering activities include some of the engineering products of Vickers-Armstrong Ltd., for which the company is a licensed manufacturer. The company is also the only licensed manufacturer in Australia of the Kort nozzle (a device to concentrate the propeller thrust of vessels such as tugs). The dockyard has four building berths, 548 feet, 475 feet, 335 feet, 318 feet, maximum 12,500 d.w. tons. (As part of the dockyard the company operates two graving docks and a floating crane—the crane can lift 150 tons and is the largest floating crane in Australia. Also, a Naval Board floating dock is on loan to the dockyard.)

During the 1939-45 War and early post-war years the dockyard built three 2,116-s.d.ton "Tribal" class destroyers (steam-turbine), two 1,092-s.d.ton sloops (steam-turbine), two 1,445-s.d.ton frigates (steam-reciprocating), eight 650- to 790-s.d.ton corvettes (steam-reciprocating), three 773-s.d.ton boom-defence ships (steam-reciprocating), and two 8,500-d.w.ton "A" class general-cargo ships (steam-reciprocating). Considerable wartime repairs and alterations to naval and merchant ships and conversions to and from war service (including full conversion of R.M.Ss. "Queen Mary", "Aquitania" and "Mauretania", and completion of conversion of R.M.S. "Queen Elizabeth", for war service as troop carriers), were also carried out. Since the war the dockyard has completed a 2,436-s.d.ton "Battle" class fleet-destroyer (steam-turbine) and two 233-ton tugs (steam-reciprocating), each tug having a Kort nozzle. The dockyard recently launched and is now fitting a 2,610-s.d.ton "Daring" class fleet-destroyer (steam-turbine), and is building another ship of the same class. The company has orders for two frigates (steam-turbine) of a fast anti-submarine class, and also has to convert two "Queensborough" class destroyers to fast anti-submarine frigates.

During the war the dockyard built six 22,000-h.p. sets of turbines for the three "Tribal" class destroyers built by it; four 1,100-h.p. sets of turbines for two sloops built by it; four 2,750-h.p. triple-expansion engines for use in pairs in frigates, both of which were built at the dockyard; sixteen 900-h.p. to 1,000-h.p. triple-expansion engines for use in pairs in corvettes, all eight of which were built at the dockyard; three 850-h.p. triple-expansion engines for three boom-defence ships built at the dockyard; two 2,650-h.p. triple-expansion engines for two "A" class general-cargo ships, one of which was built at the dockyard (the other "A" class ship built at Cockatoo Dockyard has an engine built at Mort's Dock); three 1,850-h.p. double-compound self-lubricating enclosed engines, two of which were installed in two "D" class general-cargo ships, the other of which will be used in one of two 4,750-ton colliers being built at the B.H.P. Shipyard, Whyalla (and also the thrust-block units, poppet valves, valve cam gear, piston rings, main regulating valves, engine mountings, propellers, for all ten of these engines made in Australia); six 850-h.p. "Bauer-Wach" exhaust turbines, without gearing, for "A" class general-cargo ships. In the post-war period the dockyard has built four 25,000-h.p. sets of turbines for use in pairs in two "Battle" class destroyers, one of which was built by the dockyard (and the other at H.M.A. Naval Dockyard, Williamstown); and two 900-h.p. triple-expansion engines for two tugs built at the dockyard. Currently the dockyard is carrying out an order for eight sets of turbines to be used in pairs in four "Daring" class destroyers, two of which are being built at the dockyard (and two at the Williamstown dockyard). It also has an order for eight sets of

turbines to be used in pairs in four fast anti-submarine frigates, two of which ships are to be built at the dockyard, and two at the Williamstown dockyard. All turbines—each set consisting of a high-pressure turbine combined with one or two turbines operating from steam of lower pressure from the preceding turbine—are completely built at the dockyard other than the reduction gears, which are forged and cut elsewhere in Australia. (See also Part Two of this Chapter concerning turbine manufacture in Australia.)

The dockyard also makes all the steam-raising units for all naval vessels built in Australia (a few were made elsewhere during the war, and made the steam-raising unit for all except one of the ships built by it; the dockyard also made some of the steam-raising units for merchant ships built at other yards, including fourteen of the twenty "A.S.B." water-tube boilers made for steam-driven "D" class general-cargo ships built in Australia. Auxiliary equipment and ship propellers are made.

GOVERNMENT OWNED AND OPERATED:

N.S.W. Government Engineering and Shipbuilding Undertaking (usually called the **State Dockyard**), Newcastle, N.S.W., is owned by the State of New South Wales and operated under the control of a Director who is responsible to the Minister for Public Works. The dockyard is primarily concerned with shipbuilding and ship docking and repair, but general engineering is a normal and major activity, such work including heavy cranes, electric power-station condensers and auxiliary plant, structural steel work for bridges, etc. The dockyard was established in 1942, at Dyke End, rapid establishment of the dockyard being considerably assisted by reclamation of structural members of buildings and remaining shipbuilding plant at the nearby and one-time extensive State Dockyard at Walsh Island. (That dockyard, established in 1913 after the State had transferred the Cockatoo Island dockyard to the Commonwealth Government when the Royal Australian Navy was created, had made a notable contribution to shipbuilding and ship-repair requirements during the 1914-18 War and to the Commonwealth Government shipbuilding programmes of later years up until about 1924 (when shipbuilding practically ceased in Australia), but by 1933 had completely ceased activity, and had become semi-derelict.) The Walsh Island floating dock, in two sections, was permanently joined and moved to Carrington, Newcastle, where it is operated by the State Dockyard. (The dock is by far the largest floating dock in Australia. In addition, the dockyard operates at Carrington two large hauling-up slips, and has an 80-ton floating crane.) The dockyard has, at Dyke End, four building berths, 520 feet, 435 feet, two of 350 feet, maximum 12,500 d.w. tons.

During the 1939-45 War and early post-war period the dockyard built one 1,445-s.d.ton frigate (steam-reciprocating), one 790-s.d.ton corvette (steam-reciprocating), and twenty 120-ft. auxiliary sea-going cargo smallcraft (motor). Considerable repair of merchant ships, including engine repairs, were also carried out during the war. Since the war the dockyard has completed four 2,975-d.w.ton "D" class general-cargo ships (steam-reciprocating), one 2,475-d.w.ton "D" class ship modified as a passenger-cargo ship (motor), one 3,030-d.w.ton "U/S" class general-cargo ship (motor), one side-suction hopper-dredge 636 tons gross (steam-reciprocating), one sterntrailing-suction hopper-dredge 1,044 tons gross (steam-reciprocating), and an ocean-going tug 139 tons gross (with imported diesel engine). The dockyard is currently fitting a second "U/S" general-cargo ship (motor), launched in March, 1952, and is building two 3,000-d.w.ton "D/A" class general-cargo ships (motor), one tug 150 tons gross (steam-reciprocating), two sterntrailing-suction hopper-dredges 1,044 tons gross (steam-reciprocating), one grab hopper-dredge 650 tons gross (steam-reciprocating), one "Lobnitz" rock-breaker (non-propelled) 150 tons gross, and one cutter suction dredge (non-propelled) 130 tons gross. The dockyard has no orders in hand (at June, 1952) for further ships, dredges, etc.

During the war the dockyard built four 2,750-h.p. triple-expansion engines for use in pairs in two frigates built elsewhere. Engines for the frigate and corvette built at the dockyard were built elsewhere. The 120-ft. sea-going smallcraft built at the dockyard were each powered with two 200-h.p. Ruston-Hornsby diesel engines, some of which were built in Australia (see later) and some of which were imported. Since the war the dockyard has completed three 1,850-h.p. double-compound engines, fully-enclosed and self-lubricating, two of which were installed in two "D" class general-cargo ships built at the dockyard, the other of which will be installed in one of two 4,750-d.w.ton colliers being built at The B.H.P. Shipyard, Whyalla; two 2,150-h.p. triple-expansion engines for two "B" class general-cargo ships built elsewhere; and eight 300-h.p. triple-expansion engines for two dredges built at the dockyard (two of the four engines in each dredge are used for pumping and can be used to assist in propelling). The dockyard is currently building fifteen triple-expansion engines—twelve each of 300 h.p. for use in two pairs in each of three suction hopper-dredges, two of which are being built at the dockyard and one of which (at June 1952) is being fitted by Walkers Limited, Maryborough; two each of 550 h.p. for use in a grab hopper-dredge being built at the dockyard; and one engine of 500 h.p. for a tug being built at the dockyard.

Engines for the dockyard's 2,475-ton and 3,030-ton motorships are not being made at the dockyard. The passenger/cargo ship has two imported "British-Polar" 910-b.h.p. diesel-engines connected through electric-magnetic couplings and single-reduction gearing to a single screw. The "U/S" ships, twin-screw, each have two imported "British-Polar" 725-b.h.p. diesel-engines. The "D/A" ships, twin-screw, each have two 720-h.p. "Mirrlees"-type diesel-engines, which are being built by Walkers Limited, Maryborough.

A licence to make the "Doxford" oil-engine is available to the dockyard at its option should it secure an order for the building of such an engine (the "Doxford" is being made in Australia by The Commonwealth Marine Engine Works—see later).

Shipbuilding (but not Engines)

NON-GOVERNMENT OWNED:

Evans, Deakin & Co. Ltd., Brisbane, Qld., structural, bridge, general and railways engineer, and shipbuilder, ship repairer and re-fitter, is actively engaged in all those activities (and also, extensively, as an agent and merchant for specialty engineering equipment, etc.). The company was established in 1911, and began shipbuilding in 1940. It has four building berths, two of 500 feet, two of 400 feet, maximum 10,000 d.w. tons. (The company has no dock, slip, etc., for ship repair, but operates a repair wharf.)

During the 1939-45 War the company built one 1,445-s.d.ton frigate (steam-reciprocating), eleven 650- to 790-s.d.ton corvettes (steam-reciprocating), two 8,500-d.w.ton "A" class general-cargo ships, one 1,000-ton floating dock, and two 1,200-d.w.ton oil-fuel lighters. Since the war the company has completed two more 8,500-d.w.ton "A" class general-cargo ships (steam-reciprocating), one of which is refrigerated; four 6,400-d.w.ton "B" class general-cargo ships (steam-reciprocating); and two 2,975-d.w.ton "D" class general-cargo ships (steam-reciprocating). The company is currently building one 6,400-d.w.ton "B" class general-cargo ship (motor—Australian-built 2,800-h.p. "Doxford" oil-engine); one 7,000-d.w.ton collier (motor—Australian-built 2,800-h.p. "Doxford" oil-engine) which is a modification of a "B" class ship; and one 2,100-d.w.ton "M/M" class collier (motor—one "British-Polar" 960-b.h.p. diesel-engine, imported). The company has orders for four 10,000-d.w.ton A.S.B. bulk-carriers (motor—Australian-built 3,500-h.p. "Doxford" oil-engine), laying down of which has not yet begun. (See Part Two of this Chapter for origin of Australian-built engines for merchant ships built and to be built by Evans, Deakin.)

Poole & Steel Ltd., Sydney, N.S.W., marine and general engineer, and shipbuilder, is mainly concerned with ship repair, conversion, etc., dredge and lighter building. The company was founded in 1901. During the years 1922-32 it operated at Adelaide a second shipyard at which in the 1919-23 period of shipbuilding the company built three cargo-ships of 6,200 d.w. tons, and their engines. (The Adelaide shipyard was closed down and dismantled in 1932.) The company has two building berths, 250 feet, maximum 2,500 d.w. tons. (The company has no dock for ship repairs; it has a 20-ton floating crane.)

During the 1939-45 War the company built seven 650- to 790-s.d.ton corvettes (steam-reciprocating), one 75-ft. diesel tug, two large oil-fuel lighters, and carried out considerable repairing and alterations to merchant and naval ships, and conversion of merchant ships to and from war service. No shipbuilding is being carried on at present, and the company has no orders for merchant or naval ships, or for dredges, etc. Lighters are being built.

GOVERNMENT OWNED AND OPERATED:

H.M.A. Naval Dockyard, Williamstown, Vic., is owned by the Commonwealth of Australia and is operated by the Department of the Navy. The dockyard was established as a State shipyard in 1858, when a slipway was completed; and in 1874 the graving dock came into use. The dockyard was extended early this century, and entered into building of tugs, dredges, etc. Shipbuilding began in 1913. In 1918 the Commonwealth Government acquired the dockyard from the State. Between then and 1923, six ships up to 6,200-d.w.tons were built there. In 1924 the Commonwealth offered the dockyard for sale, and it was bought by the Melbourne Harbour Trust. The Trust built dredges and barges, but was mainly concerned with docking and repair work until the 1939-45 War when it entered into the building of naval corvettes. In 1942 the Commonwealth Government resumed the dockyard for naval purposes. The dockyard has four building berths, two of 470 feet, two of 360 feet, maximum 10,000 d.w. tons. (The dockyard includes a graving dock.) Engines have never been made at the dockyard.

During the 1939-45 War the dockyard built one 1,445-s.d.ton frigate (steam-reciprocating), eight 650- to 790-s.d.ton corvettes (steam-reciprocating), two 8,500-d.w.ton "A" class general-cargo ships (steam-reciprocating), two large oil-fuel lighters and four small cargo lighters. Since the war the dockyard has completed one 2,436-s.d.ton "Battle" class destroyer (steam-turbine). It is currently fitting one 2,610-s.d.ton "Daring" class destroyer (steam-turbine), and is building another. The dockyard has orders for two frigates (steam-turbine) of a fast anti-submarine class, and also has to convert two "Queensborough" class destroyers to fast anti-submarine frigates. (See Part Two of this Chapter for origin of engines for destroyers, fast anti-submarine frigates and the two merchant ships built at the dockyard since 1939. See also Cockatoo Island Dockyard, earlier.)

Ship-Engine Building (but not Shipbuilding)

GOVERNMENT OWNED AND OPERATED:

The Commonwealth Marine Engine Works, Melbourne, Vic., owned by the Commonwealth of Australia and operated by the Department of Defence Production. The works was established in 1942, and is primarily concerned with ship-engine building, but general engineering is undertaken when capacity is available or when one of the very large machine-tools at the works is the only machine conveniently available to do the work.

The works has built two 2,650-h.p. triple-expansion engines for two "A" class general-cargo ships; four 2,150-h.p. triple-expansion engines for four "B" class general-cargo ships; and three 1,850-h.p. double-compound engines, fully-enclosed and self-lubricating, for "D" class general-cargo ships. It also did the final assembly of twenty-one "Bauer-Wach" 850-h.p. exhaust turbines and reduction gears made elsewhere (see Part Two of this Chapter) for "A" class and "B" class general-cargo ships. Many sets of steam-operated deck machinery have been made for ships built and being built in Australia to order of the Australian Shipbuilding Board. The works is carrying out, currently, an order for six of the largest internal-combustion engines made in Australia—the "Doxford" oil-engine—in this instance engines of 2,800 h.p. for five 6,400-d.w. ton general-cargo ships and one 7,000-d.w. ton collier, both types of ships being developments of the "B" class general-cargo ship. In addition the works is expected to receive an order to build five 3,500-h.p. "Doxford" engines for five of the eight 10,000-d.w. ton bulk-carriers of Australian Shipbuilding Board design to be built in Australia (the other three ships will be powered with steam-engines). The works is licensed by William Doxford & Co. Ltd., U.K., and could build the "Doxford" engine up to 6,000 h.p. in one unit.

GOVERNMENT OWNED, BUT LEASED:

The Commonwealth Marine Engine Works, Rocklea, Qld., was established in 1943, and made reciprocating steam-engines until 1949, also undertaking general engineering in the post-war period. The works and all plant have remained the property of the Commonwealth of Australia, but have been leased to The English Electric Co. Ltd. (a branch of the U.K. company of the same name). The establishment is not now engaged in ship-engine building other than as a sub-contractor for components. Should the necessity arise, the works can be returned quickly to the building of complete engines for ship propulsion.

The works built three 2,650-h.p. triple-expansion engines for three "A" class general-cargo ships; two 2,150-h.p. triple-expansion engines for two "B" class general-cargo ships; and one 1,870-h.p. double-compound, fully-enclosed, self-lubricating engine for one "D" class general-cargo ship.

(See Part Two for information showing the placing of engines made by the two Commonwealth Marine Engine Works.)

Additional Capacity for Building of Ships and Ship Engines

SHIPBUILDING: Several companies regularly engaged in fabricating of plate and structural steel could each undertake if required (such as in a defence emergency) the operation of a shipyard, particularly for building of the small ocean-going ships and smallcraft, naval and merchant. Some of the companies made lighters and smallcraft of steel during the 1939-45 War. Two companies which each operate a yard for building of steel smallcraft, barges, lighters, etc., are as follows—

A. E. Goodwin Ltd., Sydney, St. Mary's and Port Kembla, N.S.W., is a general and structural engineer, manufacturer of railways trucks, ship outfitter and repairer, and builder of smallcraft, lighters, etc. The company has at Port Kembla a small shipyard with two building berths of 350 feet, maximum 2,000 d.w. tons; the company is currently building four hopper-barges at its Port Kembla yard. (The company has no dock, hauling-up slip, etc., but it has a repair wharf at its Sydney establishment.)

Johnson's Tyne Foundry Pty. Ltd., Melbourne, Vic., is a general and marine engineer, and builder of smallcraft, lighters, barges, etc., of steel, the principal activity being general engineering. The company has two building berths, each of 200 feet, maximum 500 d.w. tons, but is not building currently. (The company has no dock, slip, etc., for repair work, but it has a repair wharf.)

SHIP-ENGINE BUILDING: Six large organisations made reciprocating steam-engines during the 1939-45 War, as an emergency measure. **Australian Iron & Steel Ltd.,** at the foundries and engineering shops at its iron works, steel works and steel mills, Port Kembla, N.S.W., built four 2,650-h.p. triple-expansion engines for four "A" class general-cargo ships. — Frigate or by two 2,750-h.p. triple-expansion engines and each 650- to 790-s.d. ton corvette by two 900-h.p. to 1,000-h.p. triple-expansion engines. **Hoskins Engineering & Foundry Ltd.,** Perth, W.A., general and structural engineers of very wide range (including ship slipway winches), built two pairs of engines for corvettes. **Perry Engineering Co. Ltd.,** Adelaide, S.A., general and structural engineers of very wide range, built five pairs of engines for corvettes. (The company also built, during the war, several all-welded steel ocean-going tugs of 75-ft. length for the U.S. and the N.E.I. Armed Forces; it later made the main condensers for The B.H.P. "Yampi" class turbine-propelled ore-carriers.) **A. Sargeant & Co. Pty. Ltd.,** Brisbane, Qld., general, structural and marine engineers, and boilermakers, built four pairs of engines for corvettes. **Thompsons Castlemaine Ltd.** (then Thompsons Engineering and Pipe Co. Ltd.), Castlemaine and Williamstown, Vic., general engineers of very wide range (including dredges), built at its Castlemaine works two pairs of engines for frigates and six pairs of engines for corvettes. The company also made during the war and in post-war years fifteen of the twenty-one 850-h.p. "Bauer-Wach" exhaust turbines required for the "A" and "B" class steam-driven general-cargo ships (twenty of which are in use); the company also made nineteen of the gear-cases required, but did not cut the gears (see Part Two of this Chapter for further comment on turbine manufacture in Australia). **Western Australian State Railway Workshops,** Midland Junction, W.A., built nine pairs of engines for corvettes.

The "Ruston-Hornsby" 200-h.p. six-cylinder diesel engine, with a Modern Wheel Drive Co. gear-box, was made by **Commonwealth Ordnance Factory**, Maribyrnong, Vic., **Charles Ruwolt Pty. Ltd.** (now Vickers-Ruwolt Pty. Ltd.), Richmond, Vic., and **George Foster & Sons Pty. Ltd.**, Sydney, N.S.W., late in the 1939-45 War and early post-war period. Each made complete engines (with the help of sub-contractors), the Ordnance Factory and Ruwolt's being the main producers, and in all about 290 engines were produced. They were used singly and in multiples for propulsion of American and Australian Armed Services smallcraft, including ocean-going.

Should it be required, the building of ship engines (particularly reciprocating steam-engines), including diesels up to 1,000 h.p., could be distributed more widely within the heavy-engineering industry in Australia, with several companies new to ship-engine building as prime contractors and assemblers.

DRY DOCKING, SLIPPING, REPAIR OF SHIPS, LIFTING FACILITIES

In general outline, there are seven types of participants in ship repair in Australia—

Shipbuilders/marine engineers combined: Seven companies or organisations, three of which are major repairers and operate docks and slips.

Royal Australian Navy: At two naval dockyards (each having a graving dock and one also a floating dock), on naval docking and repair work, one also on naval ship-building.

Dock operators (not also shipbuilders or general marine engineers): About six operators, including three harbour authorities, and including the two naval dockyards when docking merchant ships.

Marine engineers (not also shipbuilders) operating a dock: Two companies each having a small floating dock. (One company is a subsidiary company of a shipping company.)

Marine engineers (not also shipbuilders) operating large hauling-up slips: About 10 companies or businesses. (Two companies are also ship owners and operators.)

Harbour authorities operating large hauling-up slips for own work and general slipping: About 5 authorities.

Marine engineers, electricians, plumbers, shipwrights, etc., not owning or leasing dock or slip facilities: About 100 companies or businesses, including about 9 shipping companies with marine-engineering branches.

During the 1939-45 War all ship-repair facilities were utilised for naval work (and additional facilities created), but normally naval repair work is confined to three dockyards—the two naval dockyards and Cockatoo Island Dockyard (the latter a general repair dockyard).

The dock and slip operators who are also general repairers usually each reserve the right to do certain types or all of the repair work to ships docked, slipped or berthed at its establishment.

Overseas shipping lines in the Australian trade usually have their regular docking and complete surveys done at home ports, but for such ships a considerable variety of running repairs and, of course, all major repairs of an emergency nature, are carried out in Australia by the ship-repair and marine-engineering industry.

Most of the shipping companies only or mainly engaged in interstate Australian trade help themselves considerably in repair of their own ships, particularly at Sydney (which is very well placed for ship-repair work), where about nine interstate shipping companies do a varying measure of repair work for themselves—but none has a dock or hauling-up slip there. One shipping company, the home port of which is Melbourne, has at Melbourne a large repair establishment, including a small floating dock, operated by a subsidiary company, and does repair work of a wide range for itself and other shipping companies; the shipping company also has a small repair establishment at Sydney. A large shipping company, the home port of which is Adelaide, operates there a repair establishment, including a large hauling-up slip, for its own repairs and for others; it also has a repair establishment at Sydney.

Shipping companies, when not able themselves to cope with repairs either in entirety or part, contract with ship repairers to do the whole or part of a job, sometimes contracting with more than one, perhaps several, to collectively carry out, say, a complete overhaul in dock and at repair berth. When a large job such as a complete or a substantial overhaul is contracted to one ship repairer, that repairer, if equipped and staffed to handle the entire job (as all of the large repair dockyards are) will usually do the whole or most of the job itself; others sub-contract various parts of the job to specialists such as cleaners and painters, electricians, plumbers, fitters, and similar specialists who cater particularly for ship-repair work.

The two principal Australian port areas are Sydney/Newcastle and Melbourne/Geelong. The ports of Sydney and Newcastle, considered together (they are about 70 miles apart) are well provided with docks and large self-contained ship-repair organisations primarily concerned with such work, but also undertaking general engineering; and, in addition, the ship-owning companies carry out themselves a wide variety of running repairs. At all other ports or port areas, including Melbourne/Geelong (where there is insufficient docking capacity), participation in ship-repair work by companies concerned considerably with general engineering appears to be more of a rule than at Sydney.

The main facilities for ship repair throughout Australia are summarised below.

MAIN FACILITIES FOR SHIP REPAIR

Sydney, N.S.W.

DOCKS: "Captain Cook" graving dock (1,134 ft. x 148 ft. x 45 ft.; will take largest ship afloat) and floating dock (205 ft. x 16 ft. x 43 ft., for ships to 1,000 tons); both docks at H.M.A. Naval Dockyard, Garden Island, operated by Department of the Navy for naval docks and repair, and for merchant-ship docking when other suitable docks are unavailable. "Woolwich" graving dock (850 ft. x 83 ft. x 26 ft.), "Balmain" graving dock (641 ft. x 69 ft. x 20 ft.), "Woolwich" pontoon dock (195 ft. x 56 ft., for ships to 1,200 tons), and a wooden floating dock (160 ft. x 40 ft. x 12 ft., for ships to 474 tons); all four docks owned and operated by Mort's Dock and Engineering Co. Ltd., ship and ship-engine builders, ship dockers and repairers, marine and general engineers. "Sutherland" graving dock (720 ft. x 88 ft. x 32 ft.), "Fitzroy" graving dock (500 ft. x 48 ft. x 19 ft.), and "A.F.D.17" floating dock (351 ft. x 50 ft. x 16 ft., for ships to 2,750 tons); both graving docks are part of Cockatoo Island Dockyard, owned by the Commonwealth of Australia and leased to Cockatoo Docks and Engineering Co. Pty. Ltd., ship and ship-engine builders, ship dockers and repairers, marine and general engineers (subsidiary company of Vickers Ltd., U.K.), and the floating dock is on loan from the Department of the Navy. Wooden floating dock (150 ft. x 50 ft. x 11 ft., for ships to 400 tons); owned and operated by Bright's Docking Pty. Ltd., dockers and repairers. — **LARGE HAULING-UP SLIPS:** 1,500-ton, 800-ton and 700-ton slips; the three slips owned and operated by Mort's Dock and Engineering Co. Ltd. (see "Docks", above). — **LARGE CRANES:** Dockside crane, 250-ton lift at "Captain Cook" Dock; operated by H.M.A. Naval Dockyard, Garden Island. (See "Docks", above.) Floating crane "Titan", 150-ton lift; part of Cockatoo Island Dockyard establishment and operated by Cockatoo Docks and Engineering Co. Pty. Ltd. (See "Docks", above.) Floating crane 20-ton lift; owned and operated by Poole and Steel Ltd., ship builders and repairers, marine and general engineers. Floating crane 20-ton lift; owned and operated by Nicol Bros. Pty. Ltd., ship repairers, marine and general engineers. — **MARINE ENGINEERS, PLUMBERS, ELECTRICIANS, SHIPWRIGHTS, etc.:** About 40 companies and businesses, additional to those named above. Between 10 and 15 of these 40 firms do general ship repairs of all types; the remainder do only limited types of repairs or specialise in a particular type—e.g., woodworking, electrical, etc. Cleaning and descaling, etc., is confined to the dock operators and a few other firms, mainly specialists.

Newcastle, and N.S.W. Coast

DOCKS: "State Dockyard" floating dock (630 ft. x 82 ft. x 26 ft., for ships to 15,000 tons), owned by the State of New South Wales and operated by N.S.W. Government Engineering and Shipbuilding Undertaking (usually called the State Dockyard) for the Department of Public Works, for general docking, including ship cleaning and repair and marine engineering by the State Dockyard. "Riley's Hill" graving dock, near Woodburn, Richmond River (largest vessel 210 ft. x 44 ft. x 8 ft. 6 in.), "Ashby" graving dock, Maclean, Clarence River (largest vessel 145 ft. x 44 ft. x 8 ft. 6 in.), and "Terranora" graving dock, Terranora, Tweed River (largest vessel 125 ft. x 43 ft. x 8 ft.); all three docks owned by the State of New South Wales and operated by the Department of Public Works, for cleaning and repair of government dredges and punts, and general docking. — **LARGE HAULING-UP SLIPS:** 1,250-ton and 500-ton slips; owned by the State of New South Wales and operated by the State Dockyard at the floating dockyard establishment, Carrington, Newcastle. Two 150-ton slips, Newcastle, owned and operated by Ellis Davis & Son, slippers and repairers of ships. 250-ton slip at Harwood, Clarence River, owned and operated by The Colonial Sugar Refining Co. Ltd., for repair of own craft. 300-ton slip, Port Kembla; owned and operated by A. E. Goodwin Ltd., builders of steel smallcraft, barges, and structural steelwork (at Port Kembla—see also "Shipbuilding, etc.", previously this Part). — **LARGE CRANES** at Newcastle: Floating crane "Silverwater III", of 80-ton lift, owned by the State of New South Wales and operated by State Dockyard. — **MARINE ENGINEERS, PLUMBERS, ELECTRICIANS, SHIPWRIGHTS, etc.,** at Newcastle: A few companies or businesses, additional to those named above, and including The B.H.P. Co. Ltd., at Newcastle, on its own ships.

Melbourne and Geelong, Vic.

DOCKS: "Duke and Orr" graving dock (527 ft. x 70 ft. x 23 ft.); owned and operated by Duke's and Orr's Amalgamated Dry Docks Ltd., ship dockers (the company does cleaning, but no repair work). "Alfred" graving dock (470 ft. x 80 ft. x 26 ft.); at H.M.A. Naval Dockyard, Williamstown, Vic., operated by the Department of the Navy for naval shipbuilding, docking and repair, and merchant-ship docking when no other suitable dock is available. Wooden floating dock (216 ft. x 36 ft. x 13 ft., for ships to 700 tons), owned and operated by Hobson's Bay Dock and Engineering Co. Pty. Ltd., ship dockers, repairers and marine and general engineers (subsidiary company of Melbourne Steamship Co. Ltd.). — **LARGE HAULING-UP SLIPS:** 250-ton slip; owned and operated by Geelong Harbour Trust. 100-ton slip and two smaller slips; owned and operated by Melbourne Harbour Trust. — **LARGE CRANES:** Two dockside cranes, 60-ton lift and 35-ton lift, and floating crane of 40-ton lift, all owned and operated by Melbourne Harbour Trust. — **MARINE ENGINEERS, PLUMBERS, ELECTRICIANS, SHIPWRIGHTS, etc.:** About 20 companies or businesses, additional to those named above. About 10 of these 20 firms carry out all (or practically all) types of repairs. Cleaning, descaling, etc., however, is mainly done by one specialist firm and by a dock operator. The remaining firms do only limited types of repair work or specialise in one type—e.g., electrical, interior fittings, etc.

Brisbane, Qld.

DOCKS: "Cairncross" graving dock (880 ft. x 110 ft. x 37 ft.) and "South Brisbane" graving dock (495 ft. x 56 ft. x 19 ft.); both owned by the State of Queensland and operated by the Department of Harbours and Marine, for general docking, and for repair of its own craft. — LARGE HAULING-UP SLIPS: 1,000-ton slip and 400-ton slip; both slips owned and operated by H. & R. Peters, ship and boat slippers and repairers. — LARGE CRANES: No large cranes. — MARINE ENGINEERS, PLUMBERS, ELECTRICIANS, SHIPWRIGHTS, etc.: About 10 companies or businesses, additional to those named above, and including Evans, Deakin & Co. Ltd., shipbuilders, general and structural engineers.

Queensland Eastern Coast

DOCKS: No graving or floating docks. — LARGE HAULING-UP SLIPS: 200-ton slip at Mackay, owned and operated by L. E. Coleman. 150-ton slip, Rockhampton, owned by the State of Queensland and operated by the Department of Harbours and Marine. 1,200-ton slip, Townsville, owned and operated by S. W. Davids & Son, foundrymen, general and structural engineers, dredge and smallcraft repairers.

Port Adelaide, S.A.

DOCKS: No graving or floating docks. — LARGE HAULING-UP SLIPS: Three slips owned by the Harbours Board and leased—1,100-ton slip leased to and operated by Adelaide Steamship Co. Ltd., ship owners and operators, ship repairers, marine engineers; 270-ton slip leased to and operated by Central Slipping Co., ship and boat slippers and repairers, boat builders; 200-ton slip, leased to and operated by A. McFarlane & Sons, ship and boat slippers and repairers, boat builders. — LARGE CRANES: Floating crane of 60-ton lift, dockside traverser-crane of 55-ton lift, both owned and operated by S.A. Harbours Board. — MARINE ENGINEERS, PLUMBERS, ELECTRICIANS, SHIPWRIGHTS, etc.: About 10 companies or businesses, additional to those named above. Only a few of these do all types of repairs to larger vessels. The remainder specialise in a particular type of repair or handle only smaller types of vessels.

Fremantle, W.A.

DOCKS: No graving or floating docks. — LARGE HAULING-UP SLIPS: 2,000-ton slip and 500-ton slip, both owned and operated by Department of Public Works. — LARGE CRANES: Floating crane of 80-tons lift, owned and operated by Harbour Trust Commission. — MARINE ENGINEERS, PLUMBERS, ELECTRICIANS, SHIPWRIGHTS, etc.: A few companies and businesses.

Tasmanian Ports

DOCKS: Wooden floating dock (167 ft. x 37 ft. x 12 ft. 6 in., for ships to 800 tons), at Launceston; owned and operated by the Marine Board of Hobart. — HAULING-UP SLIPS: "Domain" 700-ton slip, Hobart; owned and operated by Marine Board of Hobart. 300-ton slip, Hobart, owned and operated by Purdon & Featherstone Pty. Ltd., slippers and repairers of ships and boats, and builders of smallcraft. 540-ton slip, Devonport, owned and operated by Marine Board of Devonport. Small slips at Stanley and Strahan, owned and operated by Marine Boards of Stanley and Strahan. — LARGE CRANES: Wharf-crane, 20-ton lift, Hobart, owned and operated by Marine Board of Hobart. Wharf-crane, 40-ton lift, Burnie, owned and operated by Electrolytic Zinc Co. of Australasia Ltd. — MARINE ENGINEERS, PLUMBERS, ELECTRICIANS, SHIPWRIGHTS, etc.: A few companies and businesses, additional to those named above.

Darwin

DOCKS: Floating dock for ships to 1,000 tons, owned by the Commonwealth of Australia and operated by the Department of the Navy. (This dock, by late 1952, will be located at H.M.A. Naval Dockyard, Williamstown, Vic.) The mud flats of the harbour can be used for ships up to 2,000 tons.

SMALLCRAFT

Boatbuilding, mostly of wooden construction, is carried out mainly by about sixty boatbuilders in Australia; most boatbuilders also engage in repair and slipping work. A small amount of boatbuilding and repairing is done by over 100 other smaller firms and individual builders, many of them with few employees and very little plant; boats are also built by skilled persons as a spare-time activity, either to secure a private pleasure craft or for use in professional fishing. The largest boatbuilding firm, working at normal capacity, employs about 150 persons; activities include boatbuilding and repairing, boat hiring and distribution of marine engines; this firm also exports pleasure cruisers to the United States of America, and has built vessels up to 60 feet in length for this trade.

Part Two: Outline of Capacity of Manufacturing Activities

THE construction and repair of equipment in Australia for land, water and air transport during 1949-50 accounted for about 27 per cent. (£141 million) of the value of the entire output of the engineering industries in Australia. The transport-equipment industries employed 155,500 persons, and provided equipment for the various transport services, which employed a further 250,000 persons.

Efficiency of the transport systems is of great importance to all sections of Australian industry because of the great distances existing between the major industrial centres. The subject of distribution costs is important, demanding efficient transport services. The trend towards decentralisation of industry is further increasing the already heavy demand on road, rail and air transport. (Because of natural limitations, practically no inland-water transport is in use in Australia.)

One of the outstanding features of transportation in Australia at present is the high level of demand for modern transport facilities of all types. This is due largely to rapid expansion of population and industry, coupled with deficiencies which were present at the end of the 1939-45 War. The existing railway systems are being modernised and rolling stock considerably increased, but capacity of the systems is strained to a severe extent. Drastic reductions since 1945 of imports of motor vehicles from the U.S.A. and Canada (because of restrictions imposed upon imports from hard-currency areas) further aggravated the shortages of road-transport vehicles (now disappearing).

Under these conditions the construction, assembly and repair of motor vehicles has become an important industrial activity.

Substantially increased use of air transport has also been evident. The growth of the aircraft industry in Australia in recent years has been one of the significant features of Australian industrial progress. This has been due primarily to war needs, consequently production has been mainly directed to defence-type aircraft. However, manufacture now

under way of a passenger plane for "feeder" and ambulance services indicates a growing market for lighter types of commercial aircraft, and the possibility of engaging in economic manufacture of aircraft in Australia.

This outline of the manufacturing activities of the transport-equipment industries is treated under the following headings—

Motor Vehicles—

Motor-vehicle Construction

Motor-vehicle Assembly

Motor-vehicle Body Construction and Assembly

Motor-vehicle Parts and Accessories

Motor-cycle Parts and Accessories

Bicycles and Parts

Autocycles and Motor-Scooters

Horse-drawn Vehicles

Railways, Locomotives, Railway Rolling-stock, Tramcars

Aircraft, Parts and Accessories

Shipbuilding and Ship-engine Building—

General Outline of History and Organization of the Industry: The 1914-24 Phase — The 1924-39 Phase — The Phase from 1939 to August 1952 — Types of Ships and Construction — Ship-engine Building — Equipment and Fittings.

Record of the Industry, 1939 to 1952
Australian Shipping Fleet

Maintenance of the Industry and Disposal of Ships

Ship Docking, Repair, etc.

Smallcraft

MOTOR VEHICLES

Prior to the 1939-45 War, the total demand for motor vehicles in Australia was between 75,000 and 80,000 a year, of which about 55,000 were cars or car-type utilities and the remainder commercial vehicles (trucks, buses, etc.). At that time the majority of motor vehicles were imported as "knocked-down" units, assembled in Australia, and equipped with Australian-made bodies. American vehicles predominated in the market.

During the 1939-45 War, the supply of motor vehicles was very much restricted, and a considerable backlog of orders accumulated, which was projected into the post-war years. This accumulated backlog of demand has been accompanied by high levels of current demand arising from the general level of economic prosperity. Since the war, therefore, the de-

mand for motor vehicles has been at unprecedentedly high levels. In 1950-51, there were 127,671 new cars and 77,933 new commercial vehicles registered in Australia, and in 1951-52, 121,466 new cars and 71,277 new commercial vehicles. Until late in 1951, demand remained very buoyant, a large backlog of orders was held and there was a lengthy delay in the delivery of most makes of vehicles. Since late 1951, however, there has been a change. Increased supplies have largely dissipated the backlog of demand and higher prices (including increased Sales Tax) have been accompanied by credit restrictions. With the exception of some of the more popular makes of vehicles (particularly American cars) backlogs largely disappeared.

The demand for motor vehicles has fluctuated widely over the years, and it is diffi-

cult to arrive at an estimate which will have validity other than for the short term. Despite heavy sales in the first few months of 1952 it is not likely that more than 160,000 vehicles at the most will be sold over the whole year. In fact, it is estimated that the continuing level of demand for vehicles at present would constitute an annual demand for between 130,000 and 140,000 vehicles. This demand would be particularly responsive to changes in the general level of income and particularly of availability of finance. In this regard the current fiscal year may be rather difficult. The demand may be broken down according to main types of vehicles as follows—

ESTIMATED DEMAND, 1952:		%
Passenger cars		60
Commercial vehicles—		
Utilities		20
Panel vans		3
Trucks and lorries		15
Omnibuses		1
Other (a)		1
Total		100

MOTOR-VEHICLE CONSTRUCTION

The mass production of motor vehicles in Australia commenced in 1948 with the "Holden". Since 1948, nearly 50,000 Holdens (46,123 cars and 3,793 utilities) have been registered. It is anticipated that about 30,000 Holdens will be produced in 1952.

In considering local production, regard must, of course, be also given to vehicles produced in Australia by Ford, Chrysler, and International Harvester. Volume of output here is difficult to define, as a considerable number of the major chassis components are still imported by these companies. (The activities of the four firms manufacturing vehicles in Australia have been described in Part One.) However, taking these vehicles as being Australian made, the combined annual output

(a) Station waggon and special-purpose vehicles such as street flushers, ambulances, fire carts, etc.

A fall from recent levels of sales of about 200,000 vehicles a year to about 130,000 to 140,000 vehicles should not have serious effects on the local industry. In 1950-51 imports of built-up vehicles totalled about 75,000. The majority of these were imported by assemblers who were unable to meet demand for their vehicles by importing "knocked down" units and assembling them in Australia. A fall in demand will first affect the built-up units (which, in any case, are subject to very heavy cuts under the import controls operating from March, 1952—see Appendix II). Thus, a fall in demand is likely to have little effect on Australian chassis and body production, or on the assembly of chassis and bodies from imported components and panels. Some sub-contractors, however, may have their activities curtailed during the period of re-adjustment.

of these three companies would total about 30,000 units. The current overall rate of "production" in Australia is therefore of the order of 60,000 units a year.

Most manufacturers are operating close to capacity and it is unlikely that the capacity production of the industry would exceed 65,000 units a year. Although some expansion is taking place, it is at present directed more towards increasing the Australian content than increasing the number of units produced.

Production of Australian-made vehicles in the future is likely to be maintained at least at current levels. The industry is at present having difficulty in obtaining sufficient supplies of steel sheet.

MOTOR-VEHICLE ASSEMBLY

A large proportion of motor vehicles sold in Australia are assembled locally from imported components. The vehicles are imported as "knocked down" units and arrive as a series of parts and sub-assemblies. Such items as engines, gear boxes and rear-axle assemblies arrive complete or nearly so. Prior to the 1939-45 War, the Australian motor-vehicle industry (excluding parts manufacture) consisted of the assembly of imported "knocked down" units, most of which, however, were fitted with Australian-made bodies.

It can be stated generally that it is the policy of manufacturers and assemblers of motor vehicles in Australia to progressively increase the usage of Australian-made components. Such developments will depend, however, on the ability of parts manufacturers in Australia to meet the increasing demand and to produce parts that measure up to specifications.

Imports of unassembled chassis over recent years were—

IMPORTS:	1949-50		Six months ended Dec. 1951
	no.	no.	no.
Unassembled chassis—			
Car and car type capable of use for commercial vehicles	47,261	62,577	26,078
Truck, bus and similar commercial road vehicles	38,703	49,876	26,006
Totals	85,964	112,453	52,084

Since March, 1952, however, all imports are subject to licence (see Appendix II), and unassembled chassis imports are to be reduced to 60 per cent. of the 1950-51 import value.

The above import figures include unassembled chassis for Ford, Chrysler and International Harvester. Assuming, however, that these companies' vehicles are Australian made (see "Construction" above) import figures should be adjusted accordingly. This level of imports enabled assembly in 1951 of 70,000 units (in addition to the 30,000 units for the three companies named above).

Very little equipment is required to assemble chassis and the Australian capacity is therefore limited only by the availability of labour and factory accommodation. It is estimated that the industry could assemble at least 150,000 units a year. This figure includes assembly of vehicles produced in Australia.

Since the end of the 1939-45 War, Australian assemblers of motor vehicles have been unable to meet the demands made on their capacity, and considerable numbers of vehicles have been imported "built up". Imports of complete vehicles over the past few years have been—

IMPORTS:		no.
1949-50		103,184
1950-51		74,827
1951-52		75,637

This compares with the figure of 2,165 built-up units imported in 1938-39. The recent imposition of import licensing (see Appendix II) operative from March, 1952, will considerably reduce imports of built-up vehicles.

The principal source of supply of "knocked down" and of "built up" vehicles imported into Australia is the United Kingdom. Before the 1939-45 War, the major part of the Australian market was supplied from North American sources, but currency problems, which have been greatly accentuated in recent years, have caused a substantial reduction of such imports.

BODY CONSTRUCTION AND ASSEMBLY

The motor-vehicle bodymaking industry has been well established in Australia for many years. It developed largely during the 1914-18 War from the coach-building industry and was given considerable impetus in 1917 when the Commonwealth Government, to conserve shipping space, placed a partial ban on the import of motor bodies.

All types of bodies are made in Australia. In the passenger-car class (including truck cabins) production (i.e., pressing from steel sheet) is almost exclusively carried out by General Motors-Holden, Ford and Chrysler. Some passenger bodies, mainly of the open type, are produced by other body builders.

Even where the panels for passenger vehicles are pressed locally, it is normal procedure to import the front end, i.e., engine bonnet, fenders, radiator grille, etc. Style changes most frequently affect this part of the body and the high cost of dies relative to the volume of production tends to make pressing uneconomical in Australia.

In the commercial-vehicle field, the front end is normally imported and the cabin either

Although Australian production is increasing, imports, principally from the United Kingdom, will continue to be an important source of supply to the Australian market. Future supplies, therefore, will be closely related to United Kingdom production. Present indications are that the current rate of supply to Australia from the United Kingdom could be maintained for the next twelve months. Beyond that period, the overseas supply position is uncertain, and will, no doubt, be largely governed by international developments. In any case, while Australian import quotas continue U.K. producers will be able to fill them.

pressed in Australia or assembled from imported panels. The rear end of commercial vehicles, e.g., tray and tipper bodies, is almost exclusively of Australian origin. Passenger-bus bodies are usually wholly produced in Australia.

During recent years the assembly of bodies from imported panels has increased, while the local production of bodies of the passenger car type has declined from pre-war figures. This decline in production has been brought about primarily by the shortage of skilled labour and steel, but the change in the source of supply from North America to the United Kingdom has resulted in an increased proportion of imported panels. One major problem that besets the Australian body building industry is the high cost of tooling in relation to the limited output and the range of bodies produced. This factor, in many instances, operates in favour of the importation of body panels.

Australian production of all types of motor-vehicle bodies in 1948-49 and in 1949-50 was—

	1948-49		1949-50	
	no.	£	no.	£
Sedans	25,572	5,038,016	28,158	7,064,566
Coupes	(b)	(b)	(b)	(b)
Tourers	5,850	683,004	2,767	338,949
Roadsters	(b)	(b)	(b)	(b)
Passenger buses	1,305	1,934,188	857	1,344,051
Trucks—				
With cabin	1,120	176,082	8,111	1,223,151
Without cabin	8,254	427,566	1,945	104,279
Cabins only	10,344	974,450	40	9,169
Utilities—				
New work	9,504	1,421,922	12,948	2,448,760
Conversion	183	7,336	287	44,005
Vans	1,279	253,460	1,414	348,743
Trailers	3,671	786,269	4,989	909,097
Caravans	546	216,403	658	240,074
Bodies assembled from panels imported or made elsewhere	10,676	(a)	35,138	(a)

(a) Quantity only collected.

(b) Included elsewhere.

In 1950-51, production of bodies for sedans and coupes totalled 36,476, for tourers and roadsters 4,507, and for utilities 19,604. Total body production was estimated at about 75,000 units in 1951. Of these, about 55,000 were attached to Australian-produced chassis and 20,000 to chassis which were assembled from imported components. In addition to these Australian-made bodies, those assembled from imported panels numbered about 50,000.

IMPORTS, BODIES AND PANELS:

	1948-49	1949-50	1950-51 (a)
	no.	no.	no.
Single seated and double seated bodies (not including windcreens or detachable hoods)	1,483	6,516	3,535
Bodies with fixed or movable canopy tops and bodies, n.e.i., including windcreens forming an integral part of the body			
Pressed metal panels not fabricated beyond trimming of edges	33,244 lbs.	108,968 lbs.	89,773 lbs.
Pressed metal panels, other	409,479	2,903,332	2,453,315
	917,258	5,479,030	6,028,210

(a) Preliminary figures, from Customs clearances.

It is estimated that the industry has capacity to produce at least 100,000 bodies of all types a year. This estimate refers only to bodies made or substantially made in Australia and not to those assembled from imported panels. The total assembly capacity (including assembly of Australian-made bodies) would probably exceed 150,000 units a year.

Imports of motor-vehicle bodies and of body panels have been as follows—

The manufacture of trailers and semi-trailers forms an important part of the bodymaking industry. Difficulties which developed during and since the 1939-45 War in the transport of goods by rail and by sea have led to a considerable increase in heavy road haulage, particularly interstate road transport. This has led to an increasing need for suitable vehicles, and the manufacture of trailers and semi-trailers, particularly for heavy haulage, has become increasingly important. Recent developments include the manufacture of insulated refrigeration types, and there will probably be an increasing demand for such vehicles. Other types of trailers and semi-trailers manufactured include stock-transport vehicles, tankers and timber jinkers.

The remainder of the bodymaking industry consists of the manufacture of tip and tray bodies, vans, horse-floats, ambulances, hearses, passenger coaches, buses, and similar special types of bodies. The greater portion of production is made to order and in value comprises an important part of the bodymaking industry.

Because of American limitations on the granting of export licences for sheet steel and British sheet-steel shortages, the immediate future supply of sheet steel is uncertain and may restrict body production. Although the sheet steel position generally is likely to improve, cold rolled sheet for motor bodies is likely to remain in short supply for some years.

MOTOR-VEHICLE PARTS AND ACCESSORIES

Parts and accessories are required by the motor-vehicle industry in substantial quantities for both the manufacturing and assembling sections of the industry on the one hand; and for repair work on the other. The motor-vehicle manufacturing industry is particularly suited to subcontracting for the production of many components and assemblies, and as in other parts of the world subcontracting is considerably used in Australia. Most vehicles which are assembled in Australia from imported components contain a greater or lesser proportion of Australian parts in their finished form.

AUTOMOTIVE GENERATORS AND STARTER MOTORS are not made in Australia, but there are firms in existence which are capable of making them. Manufacture of CARBURETTORS has been attempted and the capacity for large-scale production exists, but difficulty has been experienced in establishing the product with the motor trade. CLUTCH ASSEMBLIES have not been made in Australia, but production is now planned. Complete DISTRIBUTORS have not been made, although parts are made by a number of firms. Manufacture of AUTOMOTIVE ELECTRIC-LAMP GLOBES has recently commenced. INSTRUMENT-BOARD ASSEMBLIES as such are not made in Australia, but a number of the instruments are made. SPEEDOMETERS, however, are not made; imports in 1949-50 were valued at £204,784. A section of the industry is contemplating making speedometers and TAXI-METERS (which also are not made in Australia).

Of the extensive range of AUTOMOTIVE PARTS AND ACCESSORIES made in Australia, the following are among the most important: batteries; tyres; axles; brake and brake parts; cylinder blocks and heads; oil seals (leather and felt); clutch plates; filters; gears; ignition coils; piston rings; pistons; piston connecting rods; propellor-shaft assemblies; crankshaft bearings; radiators; caps and shells; springs; shock absorbers; spark plugs; wheels; universal joints ("Hardy-Spicer"); ball bearings, in a limited range of types; windshield frames; hardware (such as door handles, etc.); exhaust systems and parts; electric horns; tyre inflators.

The largest independent manufacturer of motor-vehicle spare parts and accessories in Australia (Repco Ltd.) recently formed a new company, with an authorised capital of £1,000,000, in equal association with a large British firm (Kirkstall Forge Ltd.) to manufacture heavy forgings for heavy-duty vehicles, such as FRONT-AXLE BEDS, SPINDLES and HUBS. The Australian company has also concluded an agreement with one of the largest manufacturers of motor accessories in the U.S.A. to manufacture, under licence, UNIVERSAL JOINTS (mechanical) for the motor trade.

Large quantities of these parts are also imported, but the supply of some components is still insufficient to satisfy the demand. Many parts for certain makes and models of vehicles are imported because they cannot be manufactured economically in the limited quantities required. There will, however, be a substantial expansion in this field in the near future.

An indication of the demand for vehicle parts and accessories is given by the level of imports in 1949-50 and 1950-51—

IMPORTS:	1949-50		1950-51 (a)	
	no.	£	no.	£
Chassis Parts whether Imported Separately or Incorporated in or Forming Part of a Complete Vehicle—				
Bumper bars	—	667,920	—	632,373
Radiator assemblies	145,104	1,091,887	130,122	985,493
Springs for suspension purposes	—	875,325	—	898,423
Shock absorbers	532,745	695,487	819,936	730,507
Gears imported separately or otherwise	—	207,437	—	289,301
Shackle bolts, pins and assemblies; spring hangers; king pins; tie-rod pins; tie-rod ball pins; tie-rod ball studs; U bolts	—	58,622	—	56,439
Axle shafts and propeller shafts	—	89,615	—	133,399
Chassis parts, n.e.i., not being original equipment parts of imported chassis	—	1,862,863	—	3,203,561
Motor-vehicle Parts, n.e.i.—				
Pressed metal panels not fabricated beyond trimming of edges	—	259,517	—	730,826
Pressed metal panels, other	—	643,240	—	3,644,158
Motor-vehicle parts not elsewhere specified or included	—	2,879,311	—	
Miscellaneous Vehicle Parts and Accessories—				
Axle and axle boxes, roller bearing and ball bearing	—	49,380	—	91,031
Brake and transmission lining	—	243,967	—	308,549

Hand-worked inflators (tyre pumps), inflator clips and connections	—	89,599	—	110,096
Speedometers (but not including cyclometers)	195,294	324,247	204,784	364,544
Valves for pneumatic tyres	—	146,621	—	168,546
Warning Devices—				
Audible electrical, for all road vehicles	—	249,852	—	225,013
N.E.I., including cycle bells, reflectors and reflex rear lights for use on all road vehicles	—	77,753	—	100,086
Windscreen wipers	—	392,419	—	406,499

(a) Preliminary figures, from Customs clearances.

The following are figures of Australian production of certain types of motor-vehicle (in-

cluding motor-cycle) parts and accessories in 1949-50—

1949-50			1949-50		
no.			no.		
£			£		
Axles	51,125	102,291	Spark plugs	1,491,141	184,238
Springs for suspension purposes	—	682,563	Pistons	661,604	356,136
Bumpers and bumperettes ...	75,914	166,145	Piston rings	13,296,290	474,061
Wheels	84,872	145,863	Cylinder sleeves and liners ...	163,435	144,162
Radiators, cores and assembly	117,647	707,720			

MOTOR-CYCLE PARTS AND ACCESSORIES

Motor-cycles are not made in Australia. The United Kingdom supplies about 90 per cent. of the market. Although such production might be desirable from a defence aspect, it is doubtful if the Australian market is large enough for commercial production. It would appear that the peak of demand has been reached, and in fact, demand has recently declined somewhat. It is difficult to assess at what figure demand will actually settle, but present indications are that it will be between 20,000 and 25,000 a year. There were 145,515 motor cycles registered in Australia at the end of June, 1951. Imports of motor cycles, accessories, parts, etc., in 1949-50 and 1950-51 were—

IMPORTS:	1949-50		1950-51 (a)	
	no.	£	no.	£
Motor cycles	28,911	2,909,465	23,967	2,539,478
Motor-cycle and side-car parts, n.e.i. ...	—	61,972	—	52,714
Motor-cycle and side-car accessories, n.e.i., and parts thereof	—	25,073	—	27,694

(a) Preliminary figures, from Customs clearances.

About 60 per cent. of motor-cycle accessories is made in Australia and about 50 per cent. of the spare parts. Many spare parts, such as magnetoes, generators, headlights, gear boxes, chains, etc., are not made in Australia because manufacture in the quantities required would not be economical. Shortage of motor-cycle chains has caused concern for several years. A plant to make precision roller chain for power transmission has begun production, but initially the output of this factory is chain for agricultural machinery (see Chapter 9).

Shortage of certain steels is causing difficulties in the manufacture of Australian-made spare parts.

The establishment of the motor-cycle manufacturing industry in Australia depends on the extent to which it would be feasible to set up plant, while competing with imported machines, to manufacture for a market that requires not more than 20,000 to 25,000 motor cycles a year of a wide variety of sizes and makes.

BICYCLES AND PARTS

Prior to the 1939-45 War, the range of cycle parts made in Australia was limited and the cycle industry concentrated mainly on the assembly of imported parts. During the war and in the immediate post-war years, however, imported parts were scarce, and Australian manufacture of parts was increased considerably and manufacture of a large range of parts not previously made locally was commenced. Apart from certain parts such as chain, coaster hubs and clutches, which have not been made in Australia, the cycle industry became reasonably self-sufficient.

With the return of imports in 1950 and 1951, however, a number of manufacturers found that they could not compete against imported parts and in many cases manufacture was suspended. Cycle tubing is made by British Tube Mills (Aust.) Pty. Ltd. in South Australia, but this firm, and some others, have stopped making non-tubular parts. The manufacture of remote controls of the Bowden type, which was started during the war, was recently discontinued. One manufacturer of cycle saddles and one firm making spokes have also recently stopped making these parts.

However, the Australian industry has shown its ability to make a broad range of cycle

parts, and has considerable unused capacity for such production. The recent imposition of import restrictions (see Appendix II), which restricts imports of bicycles and some parts, e.g., sprocket and chain wheels, saddles, wheel rims, to 20 per cent. of the 1950-51 value and of other parts to 60 per cent. of 1950-51 value, may perhaps stimulate a revival of cycle parts manufacture in Australia.

Specialised machines, particularly racing cycles, use light-weight components which, other than tubing, are not made in Australia and which are imported from France and Italy, both countries supplying a high-grade component.

There is no indication that bicycle chain, coaster hubs or clutches will be made in Australia in the near future.

It has been estimated that there are about one million cycles in use in Australia at the present time. Annual demand is between 100,000 and 120,000 cycles a year, of which only a very small proportion, probably less than 5 per cent., would be for replacements.

The number of cycles made or assembled in Australia over the past few years was: 1948-49, 91,514 cycles; 1949-50, 96,282 cycles; 1950-51,

112,967 cycles. In the first 8 months of 1951-52, the number of cycles made or assembled totalled 68,028, an annual rate of 102,042. These totals do not include, however, cycles built by many cycle retailers and/or repairers who also engage in building cycles, often to order.

Imports of bicycles, tricycles and similar vehicles (other than children's) in 1949-50 totalled 2,190, valued at £15,283. (Children's bicycles and tricycles imported in that year numbered 16,120, valued at £52,352.)

Australian production of cycle parts and accessories has declined in value from £380,096 in 1947-48 to £269,044 in 1948-49 and to £228,995

in 1949-50. Imports of cycle parts and accessories in 1948-49 and 1949-50 were valued at—
IMPORTS:

	1948-49	1949-50
	£	£
Balls for cycle bearings	23,267	4,096
Cycle tubing	449	1,592
Cycle frames, partly or wholly finished	24	50
Cycle parts, brazed, enamelled or permanently joined, n.e.i. . . .	11,141	24,511
Cycle parts, n.e.i.	435,614	411,805
Cycle accessories, n.e.i., and parts thereof	123,757	153,938

The value of Australian exports of all types of bicycles, tricycles and similar vehicles and of parts and accessories in 1949-50 was £28,353.

AUTOCYCLES AND MOTOR-SCOOTERS

A post-war market which has shown signs of expansion has been that of the AUTO-CYCLE; all parts, except the engine, chain and clutch for this machine are made in Australia. Small detachable 2-stroke motors, im-

ported, capable of being fitted to the ordinary pedal-type push-cycle, are being used in Australia increasingly. MOTOR-SCOOTERS are not made in Australia and as yet are far from a commonplace sight on the roads.

HORSE-DRAWN VEHICLES

The demand for HORSE-DRAWN VEHICLES in Australia has fallen considerably. Vehicles for the retail distribution of milk and bread, lorries and trotting sulkies, etc., are, however, still being made. The industry has suffered generally by the increased use of automotive transport in place of most horse-drawn vehicles (with the exception of trotting

sulkies for racing). Material and labour deficiencies, high cost of manufacture, together with limited and widely dispersed farriery capacity for the shoeing of horses, have all caused serious difficulties, and resulted in users turning to automotive vehicles. Total value of output amounted to £243,000 in 1949-50, as compared with £332,370 in 1948-49.

RAILWAY LOCOMOTIVES, RAILWAY ROLLING-STOCK, TRAMCARS

Construction of locomotives, railway rolling-stock and tramcars in Australia is carried out by railway authorities and also by some companies specialising in the manufacture of transportation equipment. The main railway systems of Australia are owned and operated by governmental authorities, and in the past the major proportion of requirements was manufactured in workshops owned and operated by those authorities. Permanent-way construction is also carried out by governmental authorities.

There are at present about 140 workshops in Australia engaged in the construction and repair of locomotives and other railway rolling-stock and of tramcars. Total value of plant and machinery in the industry amounts to about £8.5 million, of which over £8.0 million worth is installed in 128 government workshops. The industry is employing over 40,000 persons, of which only 5 per cent. are employed by private enterprise.

In the past, all State railways made much of their rolling-stock requirements and except in New South Wales the part played by private contractors was relatively small. However, the present great demand for locomotives and other rolling-stock, accentuated by shortages of material and labour, has brought private industry into prominence to supplement production from government-owned works. This heavy demand for both passenger and goods vehicles has arisen partly as a result of conditions prevailing before the 1939-45 War, when construction of locomotives and other new rolling stock had fallen considerably below

the generally accepted normal rate of replacement. This position became noticeably worse during the war and at the present time is aggravated by large replacement and modernisation programmes which the various government systems have in hand, including the electrification of certain main lines in New South Wales and Victoria, extensions to suburban electric systems in Sydney and Melbourne, and the electrification of the Brisbane suburban system; the electrification of the Adelaide system is also proposed. An example of the post-war rolling-stock requirements was the Victorian Railways 10-year programme of modernisation, a large part of which has now been carried out, involving the expenditure of more than £37 million on replacement of worn-out and obsolete rolling-stock, and £42 million on equipment and permanent-way replacement and new construction.

A survey conducted by the Australian Transport Advisory Council late in 1949 disclosed that orders for rolling-stock placed, or to be placed, during the following five years totalled more than £88 million. This value was made up as follows—

Value of local orders (current and proposed), 1950-54	£64,140,070
Value of overseas orders (current and proposed), 1950-54	24,432,217
Total	£88,572,287

Many important orders have been placed subsequently, both in Australia and overseas, but the actual level of expenditure will, of course, be dependent on the funds available.

TRANSPORT EQUIPMENT

The output of STEAM LOCOMOTIVES is appreciably below demand, because of shortages of skilled labour and some materials, particularly of suitable steel plate, supplies of which are extremely short from local production, and difficult to obtain from overseas. Heavy maintenance requirements are also pressing on capacity. Orders for complete locomotives have been placed with overseas manufacturers and substantial deliveries of these have already been made.

Because of deficiencies and frequent interruptions to the supply of coal suitable for locomotive firing, New South Wales, Victoria, South Australia and the Commonwealth have converted a number of locomotives to oil burning and further moves in this direction are taking place. In addition, tests have been carried out, in Victoria, of the operation of locomotives on pulverised brown coal. Pulverising equipment from Germany has been used and the tests have been so successful that a number of engines are to be so equipped. Considerable advantages in operating conditions result, but special arrangements have to be made for transporting and storing the fuel. (Victoria has great brown coal deposits in the Yallourn-Morwell area of Gippsland—see Chapter 1.)

DIESEL RAIL-CARS, with or without trailers are being extensively used by all the railway systems. New South Wales, Victoria and Queensland and the Commonwealth are introducing a number of air-conditioned units. The motors for these, however, have been imported.

For main-line services, steam locomotives are, and will for some time remain, the chief source of motive power, but for certain lines carrying very heavy traffic and for interstate services a considerable number of ELECTRIC and DIESEL-ELECTRIC LOCOMOTIVES is on order, the former for use on main lines in New South Wales and Victoria, now being electrified, and the latter for long-distance passenger and goods services in all States. (A number of the diesel-electric locomotives are now in use.) The Commonwealth line from Port Pirie to Kalgoorlie is to be entirely operated with diesel-electric units. Furthermore, many DIESEL - ELECTRIC SHUNTING LOCOMOTIVES are already in use, mostly as a post-war innovation, and more have been ordered. The majority of diesel-electric units are being imported complete, having been ordered from major overseas companies, and those which are built in Australia will incorporate varying quantities of imported components. Australian industry has, however, shown considerable interest in local production. Clyde Industries Ltd. has already completed, under agreement with the General Motors Corporation, several units, using imported engines and other components, and the English Electric Co., which already holds considerable orders, is planning production of various items of equipment.

Types of ROLLING-STOCK vehicles in substantial demand by Australian railways systems at the present time include: Steel main-line passenger cars, including air-conditioned stock, steel buffet-cars, passenger and goods brakevans, steel suburban electric motor and trailer-cars, coal hopper-wagons, bogie refrigerator-cars, sheep-vans, bogie flat-wagons, cattle-wagons, bogie louvered-vans and four-wheeled goods-wagons. Wagon underframes and components are also required. All these

are manufactured in railway workshops or by local contractors, but the urgent demand for new rolling stock has led to the placing of substantial orders overseas, principally for goods-wagons.

Practically all railway departments are considerably in arrears with maintenance, as well as committed to extensive programmes for new construction. Annual requirements by Australian railways for RAILS and FISH-PLATES were estimated in 1952 to be of the order of some 100,000 tons. Present production in Australia is only a little over 60,000 tons, and the balance must be met by imports, which in 1949-50 totalled over 40,000 tons, and in 1950-51 over 60,000 tons. Production will shortly be raised to 90,000 tons annually. (See also Chapter 9.)

Programmes of replacement and new construction envisaged by the railways authorities cover only the most pressing works, and work on many new lines, some of which have actually been commenced, must remain in abeyance for some time. Any extension of works programmes to include some of these would, of course, involve a considerable increase on the figure of 110,000 tons a year.

The manufacture of STREET TRAMCARS in Australia is carried out by the various tramway authorities and some private manufacturing companies. All parts, including the motors, are made in Australia, although some electrical gear is usually imported. Demand is still in excess of the capacity of the industry and the output of all workshops at the present time is restricted by shortages of skilled labour and materials. Much of the workshop construction plant is engaged in maintenance of old and obsolete tramcars, and this is retarding the construction of new tramcars.

All capital cities except Melbourne and one other city (Launceston) have installed TROLLEY-BUSES for routes and loadings considered appropriate for trolley-buses. Chassis are imported and the bodies built locally. There may be possibilities for greater use of trolley-buses and accordingly the prospect for manufacture in Australia of these vehicles or their components appears worthy of further examination.

The Melbourne and Metropolitan Tramways Board has been experimenting with a new type of tramcar, the American "President's Conference Committee" car, the design of which incorporated many new features (such as rubber-cushioned wheels) for passenger comfort and noise reduction. One trial car has been constructed at the Board's workshops using imported bogie assemblies and electrical equipment, and has been running for some time. The Brisbane City Council has equipped several of its new cars with improved bogie and transmission equipment of its own design. The Sydney Road Transport Authorities have also shown interest in this type of equipment.

Imports of RAILWAY and TRAMWAY VEHICLE CHASSIS in 1948-49 were valued at £132,009 and in 1949-50 at £168,640. Value of imports of TROLLEY-BUS CHASSIS was £33,781 in 1948-49 and £151,291 in 1949-50. The value of output in 1948-49 of government-manufactured tramway and railway rolling stock was £29 millions, and of railway rolling stock produced by other than government establishments £1.75 million; in 1949-50, value of output increased to £33 millions and £2.07 millions respectively.

AIRCRAFT PARTS AND ACCESSORIES

PRE-WAR AND WARTIME ACTIVITIES

After the 1914-18 War pioneer aircraft builders in Australia set up modest plants to construct the early types of wooden-framed fabric-covered aircraft, but it was not until 1935 that the first really consequential move was made by the Commonwealth Government in developing this industry. In that year a conference was called by the Government to consider the means that should be adopted for establishing the production of at least portion of Australia's requirements of aircraft and engines. The outcome of that conference was the formation in 1936 of the Commonwealth Aircraft Corporation Pty. Ltd. by a group of Australia's leading industrial organisations. The company established a factory at Fishermen's Bend, Melbourne, Vic., and began the manufacture of low-wing monoplanes of all-metal construction based on designs supplied by North American Aviation Inc., and of aero engines to the designs of the Pratt & Whitney Corporation, U.S.A. The factory included a large foundry for aluminium castings; during the 1939-45 War the foundry became the principal source of aluminium castings for the aircraft industry generally. Shortly after the war began, casting of magnesium began, and in 1941 another foundry was erected, specifically for magnesium castings for aircraft. In March, 1939, the company's first aircraft, the "Wirraway", a trainer and general-purpose aircraft similar to North American Aviation's "NA33", made its first flight, powered with the Pratt & Whitney single-row "Wasp" 650-h.p. engine, which was also made by the company, at the Fishermen's Bend factory.

Concurrently, de Havilland Aircraft Pty. Ltd., which was formed in Australia in 1928 as a sales and servicing organisation, was enlarging the scope of its manufacturing activities. Since 1930, the company had been making wings at Mascot aerodrome for several types of de Havilland aircraft, of which the engines, fuselages and other parts were imported from the United Kingdom. By 1939 complete airframes for "Moth" aircraft were being made in Australia by the company. The outbreak of war, with its greatly increased demand for aircraft, made it desirable—and practicable from the financial viewpoint—for manufacture of engines and metal fittings to be undertaken in Australia. Consequently, when an order was given shortly after the war began to proceed with the manufacture of "Tiger Moth" trainer aircraft, complete Australian manufacture was arranged, the manufacture of "Gypsy Major" engines for these aircraft being undertaken by General Motors-Holdens Ltd.

In 1939, also, the first steps were taken by the Commonwealth Government in accordance with the recommendation of the United Kingdom Air Mission to set up facilities for the production of airframes and assembly of "Beaufort" bomber and other types of operational aircraft. These establishments became known as the Beaufort Division workshops of the Division of Aircraft Production. Governmental aircraft factories comprised the only section of the Australian aircraft industry which at the outbreak of war in September, 1939, was being developed for the production of other than trainer aircraft.

Engines were not made and have not been made at the Government-operated aircraft fac-

tories. The Commonwealth Government, however, invited Commonwealth Aircraft Corporation Pty. Ltd. to design, build, equip and conduct a Government-owned aircraft-engine factory. C.A.C. Pty. Ltd. accepted, the factory was built at Lidcombe, N.S.W., and by late 1941 had delivered the first engines—the twin-row Pratt & Whitney "Wasp"—for use in the "Beaufort" torpedo-bomber. C.A.C. Pty. Ltd. has continued to operate the Lidcombe factory, of which the Commonwealth Government has retained ownership.

The "Tiger Moths" of the de Havilland Company and the "Wirraways" of the Commonwealth Aircraft Corporation were destined to play a vital part in the Australian section of the Empire Air Training Scheme. By December, 1941, there had been delivered to the R.A.A.F. 1,204 Australian-made trainer aircraft—449 "Wirraways", 675 "Tiger Moths" and 80 "Wackett Trainers"—and also the first seven "Beaufort" bombers. The "Wackett Trainer", an intermediate trainer, had been developed by the Commonwealth Aircraft Corporation.

Owing to the state of the war in the Pacific, it was decided by the Government in early 1942 to terminate the production of trainer planes, and to concentrate all available capacity on the manufacture of operational types of aircraft to supplement whatever supplies could be obtained from the U.S.A. and England. By August, 1945, the Australian aircraft industry had delivered about 3,500 aircraft of nine types—"Wirraway" trainer and general-purpose aircraft (one single-row "Wasp" engine); "Wackett" trainer (one "Super Scarab" engine); "Tiger Moth" trainer (one "Gypsy Major" engine); "Beaufort" long-range torpedo-bomber (two twin-row "Wasp" engines); "Beaufighter" intruder or attack fighter (two "Hercules" engines); "Boomerang" interceptor fighter (with one twin-row "Wasp"); "Dragon" trainer, transport and ambulance (with two "Gypsy Major" engines); "Mustang" high-altitude fighter (with one "Merlin" engine); and the "Mosquito" fighter-bomber intruder (with two "Merlin" engines). In addition, the "Lincoln" bomber—a development of the "Lancaster", with four "Merlin" engines—was under way as a production project.

Commonwealth Aircraft Corporation Pty. Ltd. made the airframes for the "Wirraway", "Wackett", "Boomerang" and "Mustang". The airframes for the "Beaufort" and "Beaufighter" (and "Lincoln") were made by the Government-operated aircraft factories. The "Tiger Moth", "Dragon" and "Mosquito" airframes were made by de Havilland's.

About 3,000 engines, of three types, were made during the war—the air-cooled radial "Wasp", in single-row 650 h.p. and twin-row 1,200 h.p., made by Commonwealth Aircraft Corporation Pty. Ltd.; and the air-cooled inline 130-h.p. "Gypsy Major" engine, made by General Motors-Holden Ltd. Prior to the end of the war it was decided to make the Rolls-Royce liquid-cooled in-line vee-type 1,650-h.p. "Merlin" (these engines were being made by C.A.C. Pty. Ltd. at Lidcombe by 1947, for the "Lincoln" heavy bomber). Engines imported during the war for airframes made in Australia were the Warner air-cooled radial 175-h.p. "Super Scarab", the Bristol air-cooled radial sleeve-valve 1,600-h.p. "Hercules", and the Packard-built Rolls-Royce "Merlin" (for

the "Mustang" and the "Mosquito", and for the "Lincoln" bombers made, from March, 1946, onwards, before the Australian-made "Merlin" engines became available). Also imported were more than 1,000 twin-row "Wasp" engines to supplement Australian production, as airframes for "Beaufort" bombers and "Boomerang" fighters were being made faster than engines.

During the war the Department of Aircraft Production was responsible for the control of manufacture of aircraft and engines in Australia, with responsibility for maintaining and operating Government aircraft factories and for arranging the supply of materials, tools, etc., required by the industry. Facilities were also provided by the Department for the repair and servicing of aircraft outside R.A.A.F. establishments. By the end of the war, nearly 12,000 engines and 4,250 airframes had been overhauled and repaired for the Royal Australian Air Force, United States Army Air Forces, Royal Navy, and Netherlands East Indies Forces; the principal overhaul contractors were the civilian airline operators, aircraft supply and repair companies, C.A.C. Pty. Ltd., de Havilland's, General Motors-Holden Ltd., Ford Motor Company, Clyde Engineering Co.

Propellers for all types of Australian-made aircraft have been manufactured by de Havilland Aircraft Pty. Ltd. at Alexandria, near Sydney, in a modern factory erected and equipped by the Commonwealth Government, supplementing facilities established early in 1939 in the company's premises for the manufacture of metal controllable-pitch propellers. First deliveries of complete propellers were made in June, 1940, and more than 2,000 propellers of eleven types were made before the end of the war, including both wooden and metal-bladed fixed pitch and variable-pitch non-feathering and feathering types. Very extensive service and repair work was undertaken by de Havilland's for the R.A.A.F. and the U.S.A.A.F.

POST-WAR ACTIVITIES

In accordance with national-defence policy, the nucleus of aircraft-manufacturing capacity capable of rapidly increasing output has been maintained. The three aircraft-manufacturing groups of the war period have remained active—the Government Aircraft Factories (Department of Defence Production), and the two private-enterprise groups. Programmes have been approved which will establish and maintain potential capacity for the manufacture and development of the latest types of jet-propelled aircraft and engines. The present position (at June, 1952) is set out below.

The Government Aircraft Factories have almost completed production of the "Lincoln" four-engined bomber, and are preparing for manufacture of the English Electric "Canberra" twin-jet bomber. Imported Rolls-Royce "Avon" turbo-jet engines will be fitted until the "Avon" engines to be made by Commonwealth Aircraft Corporation are available. Production has begun of pilotless target aircraft designed and developed by the Government Aircraft Factories to British Ministry of Supply specifications.

Commonwealth Aircraft Corporation Pty. Ltd. has completed its production of the "Mustang" fighter and of the "Merlin" engine. It is also approaching completion of its production of the Rolls-Royce "Nene" centrifugal-

In addition to the engine plant and propeller plant established by the Commonwealth Government and operated by aircraft-manufacturing companies, the Commonwealth established other major annexes, operated by various companies under the direction of the Department of Aircraft Production. At the heavy-forge annexe (operated by Australian Aluminium Co. Pty. Ltd.) a 35,000-lb. drop-hammer was used for engine crankcases, propeller blades and hubs and other large forgings for aircraft. An aero-electrics annexe (operated by Tecnico Ltd.) produced starters, generators, magnetos, relays, instrument and other switches, ignition harness, coils, rheostats, and similar aero-electrics. Oleo legs, tailwheel struts and retracting gear were the products of another annexe (operated by National Motor Springs Pty. Ltd.). An annexe operated by the Beaufort Division of Aircraft Production made gun turrets for "Beaufort" aircraft, modified imported turrets, and made gun mountings and harmonising gear, ammunition feeds and containers, release gear for bombs and mines, pilot's control handle assemblies, selector valve for automatic-pilot installations, and undercarriage and airframe machined parts. An instrument-maintenance laboratory (operated by Australian National Airways Pty. Ltd.) enabled the centralisation of repair and overhaul of aircraft instruments, and smaller workshops were also established elsewhere to supplement the servicing. In addition to annexes, the Commonwealth Government assisted in many ways in production of other aircraft requirements by various contractors, including instruments of all kinds, bullet-proof windscreens, flexible shafting, oil coolers, pumps (vacuum, hydraulic and fuel), landing wheels and brake units, oil-impregnated bushes, moulded plastics, high-pressure and low-pressure oxygen equipment, aluminium sheet, strip, rolled bar and extrusions to aircraft specifications.

jet engines (which are being fitted to "Vampire" aircraft being made by de Havilland's). The company has orders for the North American Aviation's "Sabre" interceptor fighter; for Rolls-Royce "Avon" axial-flow compressor-jet engines to power the single-jet "Sabre" and also the twin-jet English Electric "Canberra" bomber to be made by the Government Aircraft Factories; and for the company's "C.A.22" trainer. The trainer is entirely of Australian design, and is intermediate in purpose between an elementary trainer and an advanced trainer. It is a low-wing single-engined monoplane with fixed undercarriage, and has flaps, variable-pitch airscrew, side-by-side seating for pupil and instructor (and a third seat to the rear). The trainer is designed and equipped to take a pupil right through his basic flying course, and it will take the place of the "Tiger Moth" as the official elementary flying trainer for the Royal Australian Air Force; it will also serve to some extent as an advanced trainer. Production of the trainer may be delayed by priority of "Sabre" production. A C.A.C.-made engine will be fitted, but it has not yet been decided whether to use the single-row "Wasp Junior", about 400 h.p. (the Pratt & Whitney R985 engine not yet made in Australia) or, if production programmes permit, the "Cicada", stated to be the first air-

craft engine wholly designed and developed in Australia; it was designed by C.A.C. Ltd. to specifications of the Royal Australian Air Force, and is a seven-cylinder air-cooled radial, capable of producing 450 h.p.

de Havilland Aircraft Pty. Ltd. is engaged in production of the "Vampire" single-jet interceptor fighter and the "Vampire" dual-trainer, powered with the Rolls-Royce "Nene" jet engine made by C.A.C. Pty. Ltd. The company is also making the "Drover" light passenger/transport/ambulance plane, designed in Australia for feeder services; the plane is powered with three "Gypsy Major 10" engines, imported from the United Kingdom. This is the only civil aircraft being made in Australia, and it is being purchased by two Government airlines (Trans Australia Airlines and Qantas Empire Airways) for feeder work, and by the Department of Civil Aviation for departmental work. de Havilland's is regularly engaged in overhaul and repair of aircraft as a major activity, and operates a Government-owned annexe for propeller manufacture, including feathering types.

A further interesting development is the establishment in Australia of branches of two more U.K. aircraft companies. Fairey Aviation Co. has established Fairey Aviation Co. of Australasia Pty. Ltd., which has facilities in New South Wales for repairing framework of naval aircraft and manufacture of non-piloted target aircraft, and in South Australia for rockets and long-range weapons. Bristol Aeroplane Co. Ltd. has established Bristol Aeroplane Co. of Australia, which will concern itself with development of Bristol interests in Australia, including the establishment of a large engine-overhaul plant.

Australian industry has proved capable of producing many of the components necessary for modern aircraft manufacture. In addition to manufacture of parts to aircraft standard by several manufacturers of similar products of lesser standard, there exists a sound nucleus of specialist businesses and companies (some with overseas connections and with agencies for overseas manufacturers) making aircraft parts and accessories that can be made conveniently and economically in Australia, and in

some instances providing maintenance services of various kinds. There are, of course, many parts that must continue to be imported (particularly instruments) when manufacture of the numbers to be made of each type of aircraft are small.

Imports of aircraft engines (not including jet engines) and aircraft parts in 1948-49 and 1949-50 were as follows—

IMPORTS:	1948-49		1949-50	
	no.	£	no.	£
Engines (excluding jet)	129	389,044	133	245,121
Aircraft parts	—	1,541,054	—	1,282,559

These engines, components and accessories were for aircraft being made in Australia and for maintenance of Armed Services aircraft and civil passenger and freight aircraft. (Commercial aircraft registered in Australia at the end of 1948-49 totalled 587, including Douglas DC2, DC3, DC4 ("Skymaster") and DC6; Consolidated Vultee "Convair 240"; Lockheed 10A, 10B, 12A, "Lodestar" and "Constellation"; De Havilland "Dragon", "Dove" and "Drover"; A. V. Roe "Avro-Anson"; Bristol 170 freighter; Short "Hythe", "Sandringham" and "Solent" flying boats; and "Catalina" amphibian.)

The total value of output in 1948-49 and 1949-50 of establishments classified in official statistics as being wholly or mainly engaged in manufacture of aircraft, aircraft engines, components and/or accessories was £8.84 million and £10.8 million. These totals do not include the value of aircraft parts and accessories or of repair services originating in establishments not classified as being wholly or mainly within the aircraft industry, other than where such parts, etc., and services are used in the activities of manufacturers and/or servicing establishments classified as being within the aircraft industry.

Owing to the limited Australian market, together with the popularity and effectiveness of overseas makes, it would be economically difficult for new enterprise to establish plant exclusively for manufacture of civil aircraft in Australia. However, government aircraft policy is directed towards maintenance of a soundly-based aircraft industry, properly related to the extending Australian requirements for military and civil aircraft.

SHIPBUILDING AND SHIP-ENGINE BUILDING

GENERAL OUTLINE OF HISTORY AND ORGANISATION OF THE INDUSTRY

The 1914-24 Phase

Shipbuilding in Australia prior to 1918 was quite limited in the types and numbers of ships that were built. During the 1914-18 War, a light cruiser was built (H.M.A.S. "Brisbane"), another laid down (H.M.A.S. "Adelaide"), and three torpedo-boat destroyers were built—all at Cockatoo Island Dockyard.

The 1914-18 War caused overseas shipbuilding costs to rise well above the likely costs in Australia, and this, together with the policy of the then Commonwealth Government to extend the government-owned Commonwealth Line with Australian-built ships, made possible the very rapid development of a shipbuilding industry. The Commonwealth Line was also an innovation. It had been established during the war with ships bought in the United Kingdom and seized or captured as a result of war. At the end of the war it comprised about thirty-six ships. The Line

operated in overseas as well as coastal trade. Nineteen cargo ships—six of 5,600 deadweight tons (the "D" ships) and thirteen of 6,170 d.w. tons (the "E" ships) were built at five shipyards between 1919 and 1923, the engines, all reciprocating steam-engines, also being built in Australia. The Commonwealth Line also had five passenger-liners (the "Bay" class) of about 14,800 d.w.tons built in the United Kingdom, about 1921, and in 1924 two refrigerated cargo-ships (the "Dale" class or "F" ships) of 12,000 d.w.tons were built at Sydney; the "Dale" ships and their reciprocating steam engines were the largest built in Australia to that date—and their completion marked the close of a shipbuilding period for Australia. By this time costs of shipbuilding in Australia had risen above overseas costs. In 1923 the Commonwealth Government announced its intention of selling the ships of the Commonwealth Line, and by 1927 the Line had ceased to exist.

No merchant-cargo ship was built to ship-building-company order in the 1919-24 period—all were for the Commonwealth Line, on Government order.

The 1924-39 Phase

From 1924 to 1939 shipbuilding in Australia was desultory. Walkers Ltd. shipyard at Maryborough, Qld., went into complete disuse from 1923. The Commonwealth Government dockyard at Williamstown, Vic., was sold to the Melbourne Harbour Trust in 1924 and thus kept in use for repair work and smallcraft building. Poole & Steele Ltd. shipyard at Port Adelaide, S.A., went out of business and was dismantled in 1932. The principal shipyard in Australia, Cockatoo Island, a Commonwealth Government yard, at Sydney Harbour, N.S.W., was leased in 1933 to a private company (formed for that purpose), so that constitutional limitations could be avoided and the dockyard undertake non-government work on a wide scale in the absence of sufficient Government shipbuilding and ship-repair work. One of the principal shipyards, a State dockyard at Walsh Island, near Newcastle, N.S.W. held on mainly with ship-repair work and general engineering until 1934, when it ceased all activity, and much of the plant was sold. These were the five shipyards that comprised the shipbuilding industry of 1919-24.

In 1934 a naval-building programme was instituted with the laying down of two 1,060 standard displacement tons sloops ("Yarra" and "Swan"). Between 1934 and the beginning of the 1939-45 War, the naval programme broadened to the modernisation of two cruisers and five destroyers, and the ordering of two more sloops ("Parramatta" and "Warrego"), two "Tribal" class destroyers (a third was ordered soon afterwards), and three boom-working ships. All of this naval work, except some of the modernisation of one of the cruisers, was done at Cockatoo Dockyard.

When war appeared likely, plans began to be put into effect to organise shipbuilding, including engine building, to much greater output. The outbreak of war hastened the organising, but it was the entry of Japan into the war as an enemy that caused the considerable shipbuilding effort achieved throughout the 1939-45 War.

At the outbreak of war, Cockatoo Dockyard was the only large integrated shipbuilding and marine-engineering works in Australia that had been engaged in shipbuilding and ship-engine building in a reasonably continuous way. The Dockyard therefore found itself acting as "guide, philosopher and friend" to the industry that so rapidly expanded between 1940 and 1943.

The Phase from 1939 to Date

In March 1941 the Commonwealth Government established the Australian Shipbuilding Board, with the responsibility for developing the Australian shipbuilding and ship-repair industry as a wartime measure. (The Naval Board remained responsible for building of naval ships, but most yards built both merchant and naval ships.) The Shipbuilding Board was maintained in operation after the war for continuance of shipbuilding activities, and in April 1952 was reconstituted and is now part of the Commonwealth Department of Shipping and Transport. The Shipbuilding Board does not itself operate shipyards or shipping services, but is responsible for the design of ships built to its order, establishes specifications, calls for and considers tenders,

and places orders on Australian yards for hull building and fitting out, and on Australian and overseas engineers for main engines, boilers, auxiliary plant, instruments, etc. On completion the ships are handed over to ownership of the Commonwealth for operation by the Australian Shipping Board or, if ordered on behalf of an operator other than the Commonwealth, for sale to the company.

The Shipbuilding Board has the overall responsibility of encouraging the industry in every way open to the Board. Among various efforts, it has been required to foster the participation of manufacturers outside the industry proper to secure Australian sources of items of equipment which can be readily made in Australia.

The Australian Shipping Board is a Commonwealth Government instrumentality, and, as is also the Shipbuilding Board, is part of the Department of Shipping and Transport. The Commonwealth Government in its Shipping Board is the largest merchant shipowner and operator in Australia. Operations are confined almost entirely to the Australian coast; only occasional overseas voyages are made. The following table provides a summary of the Board's ships as at 1st August 1952—

AUSTRALIAN SHIPPING BOARD:		Approximate Ships Tonnage	
		no.	weight
Commonwealth-owned (a)	...	34	174,500
Has chartered to it—			
1 Australian-owned ship			
(b) 6 overseas-owned ships	4,450 tons 61,450 tons	7	65,900
Has chartered to other Australian shipping operators—			
2 Australian-built ships	3,560 tons		
1 overseas-built ship ..	1,640 tons		
Operates (a)	...	3	5,200
(a) Includes s.s. "Carcoola",	4,380 d.w.tons,		
bought secondhand overseas (as were four	others. 16,780 d.w.tons, of the Board's ships).		
The ship is expected to be delivered and			
in use by the end of September, 1952.			
(b) A passenger/cargo ship, the only passenger			
ship operated by the Board; the ship			
operates between east coast ports and Dar-			
win.			

The future of Commonwealth Government operation of ships is in doubt, however, and the matter has been under discussion for some time. Should it be decided to withdraw from ship owning and operation and dispose of the Commonwealth ships, it is probable that the disposal will require the purchasers to also buy the ships building or to be built on order of the Commonwealth.

Apart from tugs, dredges, ferries, etc., the only merchant shipbuilding carried on in Australia independently of the Australian Shipbuilding Board has been that of The Broken Hill Proprietary Co. Ltd., which at its own shipyard and engineering shops built six ore-carriers (including engines for five of the ships) for its own use and entirely at its own cost.

Only one ship with appreciable passenger accommodation has been built in Australia for many years—the motorship "Kabbarli", which went into use in late 1951; the ship is of 2,475 d.w.tons, and has accommodation for thirty-seven passengers and considerable cargo space. However, complete refitting of large passenger ships, including conversion following use as armed merchant-cruisers, has been carried out at three shipyards in Australia since the 1939-45 War.

Types of Ships and Construction

The types of merchant and naval ships built in Australia since 1939 are described in the "Record of the Industry, 1939 to 1952", set out later in this comment.

All merchant ships are of orthodox, well-established types, with the possible exception of a passenger/cargo motor ship (mentioned above) designed specifically for the Fremantle-Darwin run and incorporating the coupling of two engines to one propeller shaft through electric-magnetic couplings and single-reduction gearing (engines, couplings and gearing were imported, however). The largest ships ever built in Australia are four ships of the "Yampi" class ore-carrier, 12,500 d.w.tons, 525 feet long overall, 66 feet moulded breadth, 41 feet 3 inches moulded depth. For general-cargo work around the Australian coast, ships of about 6,000 tons deadweight appear to be about the largest that are preferred.

Merchant-ship construction in Australia is usually of the riveted type of hull, about 90 per cent. of the ship being riveted and the remainder welded, but a gradual change is being made to welded construction as shipyard facilities are adjusted to the needs of welding and prefabrication of ships' hulls. Two 3,000-d.w.ton general-cargo motorships now being built are about 70 per cent. welded, including the hull. (See below concerning all-welded hulls of naval ships.)

All merchant ships built in Australia have been registered by Lloyd's Register of Shipping in its highest class, 100A1. (The Register has exclusive surveyors at Sydney, Melbourne, Brisbane, Newcastle and Whyalla, and non-exclusive surveyors at Adelaide and Fremantle. Representatives are appointed at other ports as required.)

The largest naval ships to be built in Australia in recent years are four "Daring" class destroyers, each about 2,610 tons standard displacement, 390 feet long, now being built. These ships have an all-welded hull, this being rather an innovation in British naval-ship design. These ships will be driven by Australian-built turbines and armed with Australian-built main and secondary ordnance. The successful participation in naval operations at Korea of two "Battle" class destroyers built in 1950 and 1951 has emphasised the capabilities of Australian naval-ship production—in addition to Australian-built turbines these ships are mounted with the first enclosed-turret main ordnance (twin 4.5-inch guns in each turret) made in Australia.

Ship-engine Building

There has been for many years adequate capacity and experience in Australia for normal requirements in the building of multiple-expansion reciprocating steam-engines for ship propulsion; the 1939-45 War requirements drew heavily on this capacity and extended it. This was not so for manufacture of propelling steam-turbines and internal-combustion engines, and consequently most of the ships, including naval ships, built during the war and in the early post-war years are driven by "the old up-and-downers" (a marine-engineering term, not always affectionately applied); exhaust-steam turbines are fitted in twenty-one of the larger merchant ships to increase the power from the reciprocating engines.

In the period 1939 to mid-1952, 184 reciprocating steam-engines were built for propulsion of merchant and small naval ships, total-

ling about 269,300 h.p. About the most powerful of these engines were four-cylinder triple-expansion engines, developing 2,750 h.p., built for naval frigates, two to each ship and achieving 21 knots. Naval ships took 151 of the reciprocating engines, about 193,500 h.p. The other 33 engines, 75,750 h.p. are merchant-ship engines; exhaust-steam turbines operating with 21 of these engines add 17,850 h.p. In addition, 28 steam-reciprocating engines, totalling about 11,450 h.p., have been built, or are building, for tugs, dredges, etc.—twelve vessels.

Only two of the 21 merchant ships building or on firm order in Australia are to be driven by steam-reciprocating engines—both are steam-colliers of the one class, and the engines were completed about two years ago. Four of the 21 ships are to be steam-turbine driven, three probably steam-turbine driven (if not so decided they will be steam-reciprocating), and 12 ships are to be motor driven.

One small boom-defence ship to be built for the Royal Australian Navy will be powered with a reciprocating steam-engine, but destroyers and frigates building and to be built will be steam-turbine powered.

At early 1948 the first motorship (excluding auxiliary vessels) of which both the hull and engine were built in Australia was put into use, the builder of both hull and engine being Walkers Limited. Five of these ships, each of 633 d.w.tons, were built by Walkers, each driven by one 540-h.p. six-cylinder "Mirreles"-type diesel-engine. This size of engine was the largest internal-combustion engine built in Australia until recently (see below). Walkers Limited are now building four 720-h.p. diesels of the same type for two 3,000-d.w.ton ships being built at the State Dockyard, N.S.W. Imported engines have been installed in small motorships, two built and another fitting, at the State Dockyard, and a small collier now being built by Evans, Deakin & Co. Ltd.; all the engines are "British Polar" diesels.

A significant advance occurred when the building of the "Doxford" opposed-piston oil-engine began under licence of William Doxford & Co. Ltd., U.K. The Commonwealth Government Marine Engine Works, Port Melbourne, Vic., has an order from the Australian Shipbuilding Board for six 2,800-h.p. engines, the largest internal-combustion engine ever built in Australia. The first built has passed successful shop trials (it is reported to have been completed with the minimum of difficulty for a new licensee) and the second engine is almost ready for shop trials; the engines are for cargo ships of about 6,500 to 7,000 tons deadweight. The engines have few imported components, the major items being crankshaft forgings which are of a shape that cannot at present be forged in Australia. The liners (cylinders), of vanadium-titanium iron, were cast by Cockatoo Docks.

The Works is to receive an order from the Australian Shipbuilding Board for five 3,500-h.p. "Doxford" engines, for five of eight 10,000-d.w.ton bulk-carrier ships to be built in Australia to Shipbuilding Board design (the other three ships will be steamships). If required the Works could build the Doxford type of engine to 6,000-h.p. size in one unit.

A licence to make the "Doxford" oil-engine is available to the N.S.W. Government Engineering and Shipbuilding Undertaking (State Dockyard) at its option should

it secure an order for the building of such an engine.

The building of turbines for ship propulsion began in Australia in 1913, at Cockatoo Island Dockyard, when it became a Commonwealth-owned shipyard and dockyard mainly intended to serve the newly-established Royal Australian Navy. During the 1914-18 War and early post-war years the Dockyard built turbines for three small destroyers (H.M.A.S. "Huon", "Torrens", and "Swan") and for the cruiser H.M.A.S. "Adelaide". Between 1921 and 1933 turbines were built for the seaplane-carrier H.M.A.S. "Albatross". Since 1933 turbines have been built for four sloops, three "Tribal" class destroyers and two "Battle" class destroyers. The "Battle" class ships each have two sets of Parsons-type impulse reaction geared turbines, each 25,000-h.p. set comprising a high-pressure turbine and a low-pressure turbine. The Dockyard is now engaged in building eight sets of turbines for four "Daring" class destroyers and has orders to build eight sets for four fast anti-submarine frigates. Cockatoo Dockyard now makes turbine blades, but obtains the reduction gears from elsewhere. The gears for ships up to and including the "Battle" class were obtained from abroad, but a spare set of gears for "Battle" class ships has been made in Australia, and some of the sets of gears for the "Daring" class ships are now being made. It is expected that in the near future there will be adequate capacity in Australia to meet normal requirements for the forging and cutting of gears of large sizes for ship-propulsion turbine reduction gearing.

The first Australian-built merchant-ship with turbine propulsion, "Iron Yampi", 12,500 d.w.tons, was put into use in mid-1948; the boiler, turbine and gearing were imported, but arrangements were made for the building in Australia of the propelling plant for the three additional ships of the "Yampi" class remaining to be built. (The fourth "Yampi" ship is now being fitted-out, the first three are in use.) The ships were built by The Broken Hill Proprietary Co. Ltd. for its own use. The boilers were made by Babcock & Wilcox of Australia Pty. Ltd. The turbine-blade steel was imported, but the blades were made by The B.H.P. Co. Ltd. at its Whyalla, S.A., establishment. The large reduction-gear rings, about 12 feet in diameter, the largest forged rings ever made in Australia, were cast, forged ("becked") and rolled by Commonwealth Steel Co. Ltd., a B.H.P. subsidiary, Newcastle, N.S.W.; the State Dockyard and A. Goninan & Co. Ltd., Newcastle, N.S.W., assisted with machining; the Commonwealth Ordnance Factory, Bendigo, Vic., cut the first set of gears, and the newly-established gear-shop of The B.H.P. Co. Ltd. at Whyalla cut the other two sets. The three sets of turbines, each set of 5,500 h.p., were built by The B.H.P. Co. Ltd., at the engineering shops of its iron works, steel works and steel mills, at Newcastle, N.S.W.; the turbines are of the Parsons reaction type, each with high-pressure, intermediate pressure and low-pressure stages. The gear shop of The B.H.P. Co. Ltd. at Whyalla is the largest of the three works in Australia with plant to cut double-helical reduction gears for turbines. With establishment of marine-engineering shops planned for erection at Whyalla, The B.H.P. Co. Ltd. will be in a position to build under specific-purpose conditions ship engines for itself and others, particularly turbines; in the meantime its Newcastle engineering shops, in association with the Whyalla shops, will meet the company's

ship-engine building requirements. Four sets of turbines, each of 6,200 h.p., are required for the four 10,000-d.w.ton ore-carriers which the company is to build at its Whyalla shipyard for its own use (two are building, and two are yet to be laid down), but mainly because of the delivery times one complete geared turbine and two ungeared turbines will be imported from Parsons Marine Steam Turbine Co. Ltd., and The B.H.P. Co. Ltd. will build one complete geared turbine and two further sets of reduction gears. If the Australian Shipbuilding Board decides to power with turbines the three 10,000-ton steamship bulk-carriers to be built for it, and to have the turbines built in Australia, it is not unlikely that The B.H.P. Co. Ltd. would be the builders.

Each of the thirteen "A" class 8,500-d.w.ton and the eight "B" class 6,400-d.w.ton steamships built for the Australian Shipbuilding Board was fitted with a "Bauer-Wach" 850-h.p. exhaust-steam turbine. Twenty-one of these turbines were made, the last of them recently. Thompsons (Castlemaine) Ltd. was the principal manufacturer, making fifteen turbines and all the cases. Cockatoo Docks made the other six turbines. The turbine blades were imported. The gear rings were made by Thompsons and Commonwealth Steel Co. Ltd., Newcastle, N.S.W. The gears were cut by John Welsh Pty. Ltd., Melbourne, Vic., The Commonwealth Marine Engine Works, Port Melbourne, Vic., carried out the final assembly of the reduction-gear units and the final assembly of all units into the complete turbine assembly for installation in the ships.

It will be seen that capacity is readily available in Australia for the relatively limited but significant range of propelling engines required for the shipbuilding industry in Australia at its present and intended levels of activity. No real problem exists in the production of such engines in Australia.

Equipment and Fittings

The circumstances of the long-established, large and mature shipbuilding industry of the United Kingdom has led to that industry having, both as part of it and associated with it, the services of many manufacturers, often specialised, of equipment and fittings for engine room, decks, cargo handling, living quarters, navigation, etc.

In Australia the supply of equipment and fittings usually not made at the shipyard and/or engine-building works has presented major problems and delays from time to time. During the 1939-45 War, supply was made reasonably effective as one of the results of war organisation of all manufacturing. Maintenance of supply in the post-war period has required constant fostering and encouragement by the Australian Shipbuilding Board, Naval Board and the ship and engine builders, with the result that participation and experience in manufacture of equipment and fittings for the industry is extending satisfactorily.

Items of important equipment which were not made in Australia were electric winches and hatch covers of modern type. Manufacture of both items of equipment began recently, on licence from overseas manufacturers. The winches are those of Laurence Scott and Electromotors Ltd., U.K., and they are to be made by Ferrier, Dickinson & Weir-Drysdale Ltd. (subsidiary company of Federated British Engineers (N.S.W.) Ltd., Sydney,

N.S.W.); and the hatch is the MacGregor patent steel hatch cover of MacGregor & Co. (Naval Architects) Ltd., U.K., to be made by Morison & Bearby Ltd., Newcastle, N.S.W.

Most of the types of instruments required throughout a ship are imported, and it appears likely that such items will continue to be imported for some time.

RECORD OF THE INDUSTRY, 1939 to 1952

The overall result of wartime and post-war planning and encouragement of the industry is an impressive achievement for the relatively small shipbuilding and ship-engine building industry in Australia. A summation of categories of the 156 ships, totalling about 430,200 deadweight tonnage of merchant ships and about 90,000 standard displacement tons of

naval ships, built, building and to be built (excluding tugs, dredges, etc.—for details see description of each shipbuilding organisation, Part One) in Australia from (and including) 1939 to August 1952—about thirteen and a half years—is as follows (statistics compiled at Division of Industrial Development)—

SHIPBUILDING:

		1939-1952	
		no.	deadweight tonnage
MERCHANT SHIPS (a)			
In use (a)		65	430,035
Building		44	266,235
To be built		10	59,050
		11	104,750
Australian Shipbuilding Board			
In use (b)		59	364,045
Building		38	200,175
To be built		10	59,050
		11	104,750
The B.H.P. Co. Ltd. (c)		6	66,060
In use (d)		6	66,060
			standard displacement
NAVAL SHIPS (e)		no.	tonnage
In use or used (e)		91	92,273
Building		82	75,063
To be built		4	10,440
		5	6,770

(a) Includes two ships fitting-out and nearly ready for sea—one of 12,500 tons deadweight, one of 3,030 tons deadweight. Does not include two schooners and a ketch included in shipping statistics—see table of ages of ships, "Australian Shipping Fleet", later.

(b) Includes a 3,030-ton ship nearly ready for sea.

(c) Four ships totalling about 40,000 deadweight tons, for sale by the Commonwealth Government to The B.H.P. Co. Ltd., are on order from the Australian Shipbuilding Board, and are included in the A.S.B. totals above.

(d) Includes a 12,500-ton ship nearly ready for sea.

(e) Tonnage for naval ships in use or used is estimated in some instances.

Detail is provided below to set out a record of shipbuilding and ship-engine building in Australia since (and including) 1939. The record is in four sections—

Merchant Ships in Use

Merchant Ships Now Building or on Firm Order in Australia

Naval Ships in Use or Used

Naval Ships Now Building or on Firm Order in Australia

The names of shipbuilding and ship-engine building companies used in contracted form in the four sections below, are stated in full in Part One of this chapter.

MERCHANT SHIPS IN USE: 44 ships, totalling about 266,500 deadweight tons (including two ships launched and fitting-out, which will shortly be in use)—

12,500-d.w.ton ore-carrier steamship, B.H.P. "Yampi" class, specifically designed for carriage of steel-industry materials and products—single screw, open shelterdeck, four partially self-trimming holds and four hatches, ten derricks, steam winches; propelling machinery between amidships and aft hold, coal fired (with provision for conversion to oil firing when required), one set of 5,500-h.p. reaction-type (high-pressure, intermediate pressure, low pressure) geared turbines, 12 knots (at present limited to four ships, no more on order)—

Ship	In Use	Shipyard	Engine Builder (a)
Iron Yampi	June 1948	The B.H.P. Co. Ltd.	Parsons, U.K.
Iron Kimberly	Sept. 1949	The B.H.P. Co. Ltd.	The B.H.P. Co. Ltd.
Iron Derby	April 1950	The B.H.P. Co. Ltd.	The B.H.P. Co. Ltd.
Iron Wyndham	Fitting-out	The B.H.P. Co. Ltd.	The B.H.P. Co. Ltd.

(a) See "Ship-engine Building", earlier this Part.

8,500-d.w.ton general-cargo steamship, Australian Shipbuilding Board "A" class—single screw, shelter deck, five holds and five hatches, thirteen derricks, steam winches; propelling machinery amidships, mechanically coal fired or oil fired (oil firing is used), one 2,650-h.p. 3-cylinder triple-expansion engine with one 850-h.p. "Bauer-Wach" exhaust turbine, 12 knots (at present limited to thirteen ships, no more building or on order)—

Ship	In Use	Shipyard	Engine Builder (b)
River Clarence (a)	May 1943	Cockatoo Docks	Cockatoo Docks
River Burdekin	Dec. 1943	Evans, Deakin	Aust. Iron & Steel Ltd.
River Glenelg	Mar. 1944	The B.H.P. Co. Ltd.	Aust. Iron & Steel Ltd.
River Derwent	Sept. 1944	The B.H.P. Co. Ltd.	Aust. Iron & Steel Ltd.
River Fitzroy	Nov. 1944	Evans, Deakin	C.M.E.W., Rocklea
River Loddon	Dec. 1944	Williamstown	C.M.E.W., Melbourne.
River Murchison	Feb. 1945	The B.H.P. Co. Ltd.	Aust. Iron & Steel Ltd.
River Murrumbidgee . . .	July 1945	The B.H.P. Co. Ltd.	Mort's Dock
River Mitta (a)	Nov. 1945	Williamstown	C.M.E.W., Melbourne
River Murray	Nov. 1945	The B.H.P. Co. Ltd.	Cockatoo Docks
River Hunter	June 1946	Cockatoo Docks	Mort's Dock
River Norman (a)	June 1946	Evans, Deakin	C.M.E.W., Rocklea
River Burnett	Sept. 1947	Evans, Deakin	C.M.E.W., Rocklea

(a) Refrigerated.

(b) Not exhaust turbine, concerning which see "Ship-engine Building", earlier this Part.

8,030-d.w.ton ore-carrier steamship, B.H.P. "Chieftain" class, specifically designed for carriage of steel-industry materials and products—single screw, shelter deck, five partially self-trimming holds and five hatches, eleven derricks, steam winches; propelling machinery at after end, hand coal fired (with provision for conversion to oil firing), one 2,800-h.p. quadruple-expansion engine, 10 knots (at present limited to two ships, no more building or on order)—

Ship	In Use	Shipyard	Engine Builder
Iron Monarch	April 1943	The B.H.P. Co. Ltd.	The B.H.P. Co. Ltd.
Iron Duke	Aug. 1943	The B.H.P. Co. Ltd.	The B.H.P. Co. Ltd.

6,400-d.w.ton general-cargo steamship, Australian Shipbuilding Board "B" class—single screw, shelter deck, four holds and four hatches, seventeen derricks, steam winches; propelling machinery amidships, six ships mechanically coal fired, two oil fired, one 2,150-h.p. 3-cylinder triple-expansion engine with one 850-h.p. "Bauer-Wach" exhaust turbine, 13 knots (at present limited to eight ships, no more building or on order—but see later concerning two types of modified "B" class ships now being built)—

Ship	In Use	Shipyard	Engine Builder (a)
Koorawatha (was Bar-rigun)	July, 1947	The B.H.P. Co. Ltd.	C.M.E.W., Melbourne
Balarr	Nov. 1948	The B.H.P. Co. Ltd.	C.M.E.W., Melbourne
Bilkurra (b)	Sept. 1949	Evans, Deakin	C.M.E.W., Rocklea
Caloundra (was Balook)	April 1950	The B.H.P. Co. Ltd.	C.M.E.W., Melbourne
Binburra (b)	Sept. 1950	Evans, Deakin	C.M.E.W., Rocklea
Borda	June 1951	Evans, Deakin	C.M.E.W., Melbourne
Baroota (was Benarson)	Feb. 1952	The B.H.P. Co. Ltd.	State Dockyard
Woomera	July 1952	Evans, Deakin	State Dockyard

(a) Not exhaust turbine, concerning which see "Ship-engine Building", earlier this Part.

(b) Oil fired.

3,030-d.w.ton general-cargo motorship, Australian Shipbuilding Board "U/S" class, built specially to the order of the Union Steam Ship Co. of New Zealand Ltd.—twin screw, single deck, with 'tween deck and aft hold, two 5-cylinder 725-h.p. "British Polar" diesel engines, 11 knots (at present limited to two ships, no more on order)—

Ship	In Use	Shipyard	Engine Builder
Karoon (a)	Aug. 1951	State Dockyard	British Polar Engines Ltd., U.K.
Kootara (a)	Fitting-out	State Dockyard	British Polar Engines Ltd., U.K.

(a) See comment later this Part on these ships.

2,975-d.w.ton general-cargo steamship, Australian Shipbuilding Board "D" class—single screw, single deck, three holds (two refrigerated) and three hatches, ten derricks, steam winches; propelling machinery between amidships and aft hold, six mechanically coal fired, three oil fired; eight of the ships each have an imported engine described in footnote (at present limited to nine ships, no more building or on order)—

Ship	In Use	Shipyard	Engine Builder
Delamere	May 1946	The B.H.P. Co. Ltd.	C.M.E.W., Melbourne
Dandenong	Sept. 1946	The B.H.P. Co. Ltd.	C.M.E.W., Melbourne
Dorrigo (b)	May 1946	State Dockyard	Cockatoo Docks (a)
Daylesford	Dec. 1946	The B.H.P. Co. Ltd.	C.M.E.W., Melbourne
Dubbo	Feb. 1947	State Dockyard	State Dockyard (a)
Dalby	April 1947	Evans, Deakin	Cockatoo Docks
Delungra	Oct. 1947	State Dockyard	State Dockyard
Dulverton (b)	June 1948	Evans, Deakin	C.M.E.W., Rocklea
Denman (b)	June 1949	State Dockyard	N.E. Marine Co. (1938) Ltd., U.K. (b)

(a) Cockatoo Docks and N.S.W. State Dockyard each built three engines—see 4,750-d.w.ton collier, later.

(b) Oil fired.

(c) N.E. Marine Co. Ltd. supplied steam-raising plant and engine. Engine is 1,400-h.p. 3-cylinder re-heat triple-expansion, giving 11 knots.

2,475-d.w.ton passenger/cargo motorship, modified from Australian Shipbuilding Board "D" class and built specially for the State Shipping Service of Western Australia—single screw, combined bridge and poop deck, accommodation for thirty-seven passengers, five holds (one refrigerated and two holds with orlop

decks for carriage of 200 cattle) and five hatches, eleven derricks, electric winches; propelling machinery amidships, two 5-cylinder 910-b.h.p. "British Polar" diesel engines connected through a British-Thomson-Houston unit with electric-magnetic couplings and single-reduction gearing to single propeller shaft, 12 knots (at present limited to one ship, no more on order)—

Ship	In Use	Shipyard	Engine Builder
Kabbarli (was Don-garra) (a)	Nov. 1951	State Dockyard	British Polar Engines Ltd., U.K.

(a) See comment later this Part on this ship.

633-d.w.ton general-cargo motorship, Australian Shipbuilding Board "E" class—single-screw, raised quarter-deck, two holds and two hatches, three derricks, electric winches; propelling machinery aft, one 540-h.p. 6-cylinder "Mirrlees"-type diesel engine, 10 knots (at present limited to five ships, no more building or on order)—

Ship	In Use	Shipyard	Engine Builder
Eugowra	Jan. 1948	Walkers Limited	Walkers Limited
Enfield	July 1948	Walkers Limited	Walkers Limited
Edenhope	Mar. 1949	Walkers Limited	Walkers Limited
Elmore	Nov. 1949	Walkers Limited	Walkers Limited
Euroa	Aug. 1950	Walkers Limited	Walkers Limited

In addition, about thirteen tugs, three large dredges, two 1,000-ton floating docks and many lighters were built during the war and post-war years up to 1952; several of the tugs, the two floating docks and many of the lighters were for naval use. (See "Smallcraft", later, for comment on sea-going smallcraft.)

MERCHANT SHIPS NOW BUILDING OR ON FIRM ORDER IN AUSTRALIA: 21 ships, totalling 163,800 deadweight tons—10 ships, 59,050 tons, are building and 11 ships, 104,750 tons, are on firm order but are not yet laid down—

10,000-d.w.ton bulk-carrier ship, Australian Shipbuilding Board 10,000-ton bulk-carrier class—single screw, single deck, in two types, motor and (possibly) steam-turbine (a)—

Five motorships, three partially self-trimming holds and five hatches, no cargo-handling gear; propelling machinery at after end, one 3,500 h.p. "Doxford" oil engine, 12 knots—

Shipyard	Number to Be Built	Hull-building Stage	Engine Builder
The B.H.P. Co. Ltd.	One	Not yet laid down	C.M.E.W., Melb.
Evans, Deakin	Four	Not yet laid down	C.M.E.W., Melb.

Three steamships, four partially self-trimming holds and four hatches, no cargo-handling gear; propelling machinery between amidships and aft hold, mechanically coal fired (with provision for oil firing), type of engines not yet decided—

Shipyard	Number to Be Built	Hull-building Stage	Engine Builder
The B.H.P. Co. Ltd.	Three	Not yet laid down	No order placed

(a) Not yet decided whether the engines will be turbines or reciprocating. Two 10,000-ton steamship bulk-carriers on order in the United Kingdom from the Commonwealth Government will have reciprocating engines.

10,000-d.w.ton ore-carrier steam-turbine ship, B.H.P. "Whyalla" class, specifically intended for carriage of steel-industry materials and products—single screw, shelter deck, four partially self-trimming holds and four hatches, eight derricks, electric winches; propelling machinery between amidships and aft hold, mechanically coal fired (with provision for oil firing), one set of geared turbines of about 6,200 h.p., 14 knots—

Shipyard	Number to Be Built	Hull-building Stage	Engine Builder
The B.H.P. Co. Ltd	Four	Two building Two not yet laid down	Parsons, U.K. (a) The B.H.P. Co. Ltd. (a)

(a) Parsons Marine Steam Turbine Co. Ltd., U.K., will supply one complete geared turbine and two ungeared turbines. B.H.P. will make one complete geared turbine and two sets of reduction gears. See "Ship-engine Building", earlier this Part.

7,000-d.w.ton motor-collier, modified from Australian Shipbuilding Board "B" class—single screw, single deck, four self-trimming holds and four hatches, no cargo-handling gear; propelling machinery at after end, one 2,800-h.p. "Doxford" oil engine, 12 knots—

Shipyard	Number to Be Built	Hull-building Stage	Engine Builder
Evans, Deakin	One	Building	C.M.E.W., Melb.

6,400-d.w.ton general-cargo motorship, modified from Australian Shipbuilding Board "B" class—single screw, shelter deck, five holds and five hatches, seventeen derricks, electric winches; propelling machinery amidships, one 2,800-h.p. "Doxford" oil engine, 12 knots—

Shipyard	Number to Be Built	Hull-building Stage	Engine Builder
Evans, Deakin	One	Building	C.M.E.W., Melb.
Mort's Dock	Two	Both building	C.M.E.W., Melb.

4,750-d.w.ton steam-collier, Australian Shipbuilding Board 4,750-ton collier class—single screw, raised quarter deck, four partially self-trimming holds and four hatches, eight derricks, steam winches; propelling machinery aft, oil fired, one 1,850-h.p. 4-cylinder double-compound fully-enclosed self-lubricating engine, 11 knots—

Shipyard	Number to Be Built	Hull-building Stage	Engine Builder
The B.H.P. Co. Ltd.	Two	One building One yet to be laid down	Cockatoo Docks (a) State Dockyard (a)

(a) The engines are already built.

3,000-d.w.ton general-cargo motorship, Australian Shipbuilding Board "D/A" class—twin screw, single deck, three holds and three hatches, eleven derricks, electric winches; propelling machinery between amidships and aft hold, two 720-h.p. "Mirreles"-type diesel engines, 10 knots. In two types: One ship with combined bridge and poop deck; the other ship with single deck, extended forecastle to be used for carriage of about fifty cattle, refrigerated-cargo chambers at forward and after ends of upper deck—

Shipyard	Number to Be Built	Hull-building Stage	Engine Builder
State Dockyard	Two	Both building	Walkers Limited

2,100-d.w.ton motor-collier, Australian Shipbuilding Board "M/M" class, built specially for McIlwraith, McEacharn Ltd.—single screw, raised quarter-deck, two partially self-trimming holds and two hatches; no cargo-handling gear; propelling machinery aft, one 960-b.h.p. "British Polar" diesel engine, 10 knots—

Shipyard	Number to Be Built	Hull-building Stage	Engine Builder
Evans, Deakin	One	Building	British Polar Engines Ltd., U.K.

NAVAL SHIPS IN USE OR USED: 82 ships, totalling about 76,250 standard-displacement tons—

2,436-s.d.ton fleet destroyer, "Battle" class—twin screw; main armament four 4.5-in. guns in two twin-turrets, twelve high-angle guns with "S.T.A.A.G." mountings, and several 21-in. torpedo tubes; oil fired, two 25,000-h.p. sets of Parsons-type impulse reaction geared turbines, 32 knots (at present limited to two ships, no more on order)—

Ship	In Use	Shipyard	Engine Builder
Tobruk	May 1950	Cockatoo Docks	Cockatoo Docks
Anzac	Mar. 1951	Williamstown	Cockatoo Docks

2,116-s.d.ton destroyer, "Tribal" class, Improved—twin screw; main armament six 4.7-in. and two 4-in. high-angle guns, and four 21-in. torpedo-tubes; oil fired, two 22,500-h.p. sets of Parsons-type impulse reaction geared turbines, 36½ knots (at present limited to three ships, no more on order)—

Ship	In Use	Shipyard	Engine Builder
Arunta	April 1942	Cockatoo Docks	Cockatoo Docks
Warramunga	Dec. 1942	Cockatoo Docks	Cockatoo Docks
Bataan	June 1945	Cockatoo Docks	Cockatoo Docks

1,092-s.d.ton sloop, "Grimsby" class—twin screw; main armament two 4-in. high-angle guns; oil fired, two 1,100-h.p. sets of Parsons-type impulse reaction geared turbines, 17 knots (at present limited to two ships, no more on order)—

Ship	In Use	Shipyard	Engine Builder
Parramatta	April 1940	Cockatoo Docks	Cockatoo Docks
Warrego	Aug. 1940	Cockatoo Docks	Cockatoo Docks

773-s.d.ton boom-working ship—single screw; oil fired, one 850-h.p. 3-cylinder triple-expansion engine, 11½ knots (at present limited to three ships, but three more similar ships are to be ordered)—

Ship	In Use	Shipyard	Engine Builder
Koala	Mar. 1940	Cockatoo Docks	Cockatoo Docks
Kangaroo	Sept. 1940	Cockatoo Docks	Cockatoo Docks
Karang	Dec. 1941	Cockatoo Docks	Cockatoo Docks

Convoy Frigates and Ocean Minesweepers ("Corvettes"): The first and last corvettes were completed in January, 1941, and April, 1944, and the first and last frigates in December, 1943, and December, 1946—

12 Convoy Frigates of 1,445 tons standard displacement, twin-screw, two 2,750-h.p. 4-cylinder triple-expansion engines, 21 knots

60 Corvettes of from 650 tons to 790 tons standard displacement, twin screw, two 900-h.p. to 1,000 h.p. 3-cylinder triple-expansion engines, 15 knots

Shipyard and/or Engine-builder	Ships Built no.	Sets of Engines Built (a) no.	Ships Built no.	Sets of Engines Built no.
Mort's Dock	4	4	14	10
Walkers Ltd.	3	4	7	16

TRANSPORT EQUIPMENT

Cockatoo Docks	2	2	8	8
State Dockyard	1	2	1	—
Evans, Deakin	1	—	11	—
Williamstown Dockyard	1	—	8	—
Poole & Steele	—	—	7	—
The B.H.P. Co. Ltd.	—	—	4	—
Thompsons Engineering	—	2	—	6
W.A. Railways Workshops	—	—	—	9
Sargeant's (Brisbane)	—	—	—	4
Perry Engineering	—	—	—	5
Hoskins Engineering	—	—	—	2

(a) Two spare sets of frigate engines were built.

In addition, several tugs, three floating docks and many lighters and seagoing smallcraft were built for naval use. (See "Smallcraft", later, for comment on seagoing smallcraft.)

NAVAL SHIPS NOW BUILDING OR ON ORDER in AUSTRALIA: 9 ships, totalling about 17,200 standard-displacement tons—

2,610-s.d. ton fleet destroyer, "Daring" class—twin screw, all-welded hull; main armament six 4.5-in. guns in three twin-turrets, six 40-mm. anti-aircraft guns, and several 21-in. torpedo tubes; oil fired, two sets of geared steam-turbines, more than 30 knots—

Shipyard	Number to Be Built	Hull-building Stage	Engine Builder
Cockatoo Docks	Two	One launched and fitting	Cockatoo Docks
Williamstown	Two	One building Two building	Cockatoo Docks Cockatoo Docks

Fast anti-submarine frigate (tonnage undisclosed)—twin screw, all-welded hull; armament undisclosed; oil fired, two sets of geared steam-turbines, speed undisclosed—

Shipyard	Number to Be Built	Hull-building Stage	Engine Builder
Cockatoo Docks	Two	Not yet laid down	Cockatoo Docks
Williamstown	Two	Not yet laid down	Cockatoo Docks

Boom-working ship—hull and engine similar to the three boom-working ships described in previous table—

Shipyard	Number to Be Built	Hull-building Stage	Engine Builder
Walkers Limited	One	Not yet laid down	Walkers Limited

In addition, other boom-working ships and several smallcraft vessels have been approved for construction, but orders have not yet been placed.

SUMMARY OF SHIPBUILDING: The table set out below provides a summary of Australian shipbuilding for the period 1939-1952—the number and tonnage of ships, built, building and to be built (on firm order) and totals, for each shipyard and for Australia. The table does not include tugs, dredges, ferries, etc.

SUMMARY, AUSTRALIAN SHIPBUILDING, 1939-1952:

	Totals Built, Building, To be Built				Built				Building				To be Built			
	Merchant		Naval (a)		Merchant		Naval (a)		Merchant		Naval (a)		Merchant		Naval (a)	
	d.w. no. tons	s.d. no. tons	d.w. no. tons	s.d. no. tons	d.w. no. tons	s.d. no. tons	d.w. no. tons	s.d. no. tons	d.w. no. tons	s.d. no. tons	d.w. no. tons	s.d. no. tons	d.w. no. tons	s.d. no. tons	d.w. no. tons	s.d. no. tons
The B.H.P. Co. Ltd.	28	232,585	4	2,800	18	143,085	4	2,800	3	24,750	—	—	7	64,750	—	—
Cockatoo Docks	2	17,000	23	29,997	2	17,000	19	21,777	—	—	2	5,220	—	—	2	3,000
Evans, Deakin	17	121,050	12	9,145	10	65,550	12	9,145	3	15,500	—	—	4	40,000	—	—
Mort's Dock	2	12,800	18	15,580	—	—	18	15,580	2	12,800	—	—	—	—	—	—
Poole & Steele	—	—	7	4,900	—	—	7	4,900	—	—	—	—	—	—	—	—
State Dockyard	9	26,435	2	2,145	7	20,435	2	2,145	2	6,000	—	—	—	—	—	—
Walkers Ltd.	5	3,165	11	10,005	5	3,165	10	9,235	—	—	—	—	—	—	1	770
Williamstown	2	17,000	14	17,701	2	17,000	10	9,481	—	—	2	5,220	—	—	2	3,000
Totals, all shipyards	65	430,035	91	92,273	44	266,235	82	75,063	10	59,050	4	10,440	11	104,750	5	6,770

(a) Naval tonnages are approximate in some instances.

SUMMARY OF SHIP-ENGINE BUILDING: The table set out below provides a summary of Australian ship-engine building for the period 1939-1952—the type of engines built in that period, number and approximate horsepower, and totals, for each engine builder and for Australia.

All of the reciprocating steam-engines have been built except one (an 850-h.p. triple-expansion engine to be built by Walkers Limited for a naval boom-defence ship). All of the exhaust-steam turbines have been built. The engines being built are one set of turbines by The B.H.P. Co. Ltd. (and possibly three further sets), sixteen sets of turbines for naval ships, by Cockatoo Docks, two diesel engines by Walkers Limited, and ten oil-engines by Commonwealth Marine Engine Works, Melbourne. The table does not include engines for tugs, dredges, ferries, etc.—for details see description of each shipbuilding organisation, Part One (particularly State Dockyard, N.S.W., which is building several sets of engines for dredges).

SUMMARY, AUSTRALIAN SHIP-ENGINE BUILDING, 1939-1952:

	Totals, All Types of Engines		Steam Reciprocating		Exhaust-steam Turbine (a)		Sets of Steam Turbines		Diesel or Oil	
	no.	h.p.	no.	h.p.	no.	h.p.	no.	h.p.	no.	h.p.
Aust. Iron & Steel Ltd. (b)	4	10,600	4	10,600	—	—	—	—	—	—
The B.H.P. Co. Ltd	6	28,300	2	5,600	—	—	(c) 4	(c) 22,700	—	—
Cockatoo Docks	64	644,700	28	39,600	6	5,100	30	(d) 600,000	—	—
C.M.E.W., Melbourne	20	53,750	9	19,450	—	—	—	—	11	34,300
C.M.E.W., Rocklea	6	14,100	6	14,100	—	—	—	—	—	—
Hoskins Engineering	4	3,800	4	3,800	—	—	—	—	—	—
Mort's Dock	30	46,300	30	46,300	—	—	—	—	—	—
Perry Engineering	10	9,500	10	9,500	—	—	—	—	—	—
Sargeant's (Brisbane)	8	7,600	8	7,600	—	—	—	—	—	—
State Dockyard	9	20,850	9	20,850	—	—	—	—	—	—
Thompson's, Castlemaine	31	35,150	16	22,400	15	12,750	—	—	—	—
Walkers Limited	50	58,830	41	53,250	—	—	—	—	9	5,580
W.A. State Railways	18	17,100	18	17,100	—	—	—	—	—	—
Totals, all builders	260	950,580	185	270,150	21	17,850	34	622,700	20	39,880

(a) Used with reciprocating steam-engines of 2,650 h.p. and 2,150 h.p., in "A" and "B" class steamships of the Australian Shipbuilding Board.

(b) Subsidiary company of The B.H.P. Co. Ltd.

(c) It is possible that the company may build three sets of turbines, each set of about 3,500 h.p., for the Australian Shipbuilding Board. See "Ship-engine Building", earlier this Part.

(d) Includes an estimate of the power of the turbines for "Daring" class destroyers (eight sets) and fast anti-submarine frigates (eight sets), the power of which has not been disclosed.

AUSTRALIAN SHIPPING FLEET

At August 1952 merchant shipping operating regularly on the Australian coast and from Australia to Papua, New Guinea, New Hebrides and other nearby Pacific Islands (and including three ships—two timber ships and one passenger/cargo ship—registered in Australia and usually used only between Australia and New Zealand), totalled 200 ships, about 815,200 deadweight tons. A summary is as follows (source of all shipping statistics in this section is the Department of Shipping and Transport)—

AUSTRALIAN SHIPPING FLEET:	Approximate Ships (a) Tonnage	
	no.	deadweight
Total capacity	200	815,189
Australasian owned or registered (b)	181	647,668
Overseas owned, on charter (c)	19	167,521
Interstate (d)	159	778,191
Intrastate	41	36,998
Cargo (excluding overseas-owned ships on charter)—		tons
97 general-cargo ships (e)	224,882	
69 bulk-cargo ships (f)	354,500	
Passenger/cargo (g)	166	579,382
Australian built (h)	15	68,286
Overseas built	60	301,019
	121	346,649

(a) Does not include ships of less than 200 tons gross, nor ferries, tugs, paddle-steamers, dredges, pilot steamers, lightships, etc.

(b) Includes four ships registered and owned in New Zealand, but operating only on the Australian coast.

(c) All are cargo ships; present re-delivery dates of the nineteen ships range from September, 1952, to September, 1954, mostly in 1953. In addition, a further five cargo ships, 38,500 deadweight tons, have been time chartered from overseas owners and will be delivered in August, September and October, 1952; re-delivery dates of these ships begin at late 1953 and end late 1954.

(d) Includes three ships engaged regularly on an Australia/New Zealand run, and others running to New Guinea, New Hebrides, etc. Includes the nineteen chartered overseas-owned ships.

(e) Includes the ships usually carrying timber as the only or main cargo.

(f) The greater part of this tonnage is regularly engaged in carrying raw materials for the

iron and steel industry, steel-mill products, and coal. The remainder is engaged in carrying calcines, concentrates, etc., sugar, explosives, sulphuric acid.

(g) All Australian owned, and including one on the Australia/New Zealand run. The gross tonnage of the fifteen ships is about 95,000 tons.

(h) Not necessarily including main engines.

Types of Ships—Motorships, etc.

The following table shows the number and tonnage of motorships, steamships that can only be coal fired, and steamships which are or can be oil fired (including those also equipped to burn coal)—

MOTORSHIPS, STEAMSHIPS, etc.:	Motor-ships		Coal Fired Only		Oil Fired, or can be Oil Fired	
	no.	d.w. tons	no.	d.w. tons	no.	d.w. tons
Totals, owned and chartered	56	119,715	106	422,533	38	272,941
Australasian owned or registered (a)	54	111,430	97	331,744	30	204,494
Overseas owned, on charter	2	8,285	9	90,789	8	68,447
Interstate (b)	45	111,020	77	394,386	37	272,785
Intrastate	11	8,695	29	28,147	1	(f) 156
General cargo (c)	37	49,347	50	124,075	10	51,460
Bulk cargo (c)	5	4,398	46	205,694	18	144,408
Passenger/cargo (d)	12	57,685	1	1,975	2	8,626
Australian built (e)	14	10,549	24	120,326	22	170,144
Overseas built (c)	40	100,881	73	211,418	7	34,194

(a) See footnote (b), previous table.

(b) Includes all overseas-owned ships on charter.

(c) Excludes all overseas-owned ships on charter.

(d) The gross tonnages are: Motorships, 82,862 tons; coal-fired only, 2,025 tons; and oil-fired, etc., 10,156 tons.

(e) Two of the fourteen ships are 2,475 and 3,030 tons deadweight and have imported engines. Five of the remaining ships are each 633 tons deadweight and have Australian-built engines. None of the remaining seven ships exceeds 300 tons deadweight, and only one of these, a twin-screw ex-Armed Services auxiliary ship has Australian-built engines (two 200-h.p. Ruston-Hornsby type diesels); some of these small ships are rigged and use the engines as auxiliary power.

(f) 228 tons gross.

Most of the oil-fired ships can also be coal fired if required, but such ships are at present usually oil fired. Many of the oil-fired ships are owned and operated by the Commonwealth Government.

Operators of Shipping Fleet

There are four broad categories of operators of the Australian merchant-shipping fleet. These categories and the ships actually operated (that is, including ships on charter, excluding ships owned but chartered to others) by each operator, at 1st August 1952, was as follows—

AUSTRALIAN MERCHANT SHIPPING:	Approximate	
	Ships	Tonnage
	no.	deadweight
Australian Shipping Board (a) ..	38	235,200
The Broken Hill Proprietary Co. Ltd. (b) ..	15	113,048
Non-government operated other than The B.H.P. Co. Ltd.—36 operators (c) (d) ..	143	457,367
Western Australia State Shipping Service (e) ..	4	9,574
Totals ..	200	815,189

(a) Commonwealth Government instrumentality.

(b) All ships are operated only for use of the B.H.P. steel industry group—see Chapter 9.

(c) All passenger ships of the Australian shipping service are owned by this group, and all operated by the group except one ship chartered to the Australian Shipping Board.

(d) The ten largest operators, none of which has less than three ships or 15,000 tons deadweight (one operates 25 ships, 95,844 d.w.tons), operate 85 ships (59 per cent.), 379,400 deadweight tons (83 per cent.).

(e) A State Government instrumentality, owning three ships and chartering one from the Australian Shipping Board.

Ages of Ships of the Australian Fleet

The ages of the 181 ships owned or registered in Australasia (including four ships owned and registered in New Zealand, but operating only on the Australian coast) are as follows—

AGES OF SHIPS:	Australian Built		Overseas Built		Totals	
	no.	d.w. tons	no.	d.w. tons	no.	d.w. tons
Built before 1928 (a) ..	14	49,181	57	129,109	71	178,290
Built 1928-38 ..	1	(b) 140	46	154,405	47	154,545
Built since 1938 ..	(c) 45	251,698	18	63,135	63	314,833
Totals ..	60	301,019	121	346,649	181	647,668

(a) That is, twenty-five years ago—see text below.

(b) 247 tons gross.

(c) Includes three small ships—a wooden motor schooner built in 1940, 294 tons gross, about 300 tons deadweight; a wooden motor-powered lighter built as an Armed Services smallcraft in 1945, 305 tons gross, 300 tons deadweight; and a steel motor schooner built in 1948, 242 tons gross, 200 tons deadweight.

Additional Shipping Required

It is estimated by the Commonwealth Department of Shipping and Transport that at the present time another 75,000 tons deadweight of shipping is required to meet additional coastal requirements, particularly for bulk carriage. In addition, about 150,000 tons deadweight is required by the end of 1954 to replace present overseas-owned ships on time charter in Australia; it is thought likely that the present tonnage in Australia chartered from overseas will not increase considerably in the immediate future.

The tonnage now building and on firm order, in Australia and abroad, will add about 202,000 deadweight tons by 1958; but, based on present trends, approximately 180,000 deadweight tons of obsolete shipping (ships more than twenty-five years old) will have been replaced by the new ships, leaving a net gain of about 40,000 tons. It appears that over the next five or six years, to enable the Australian shipping service to be kept at a level not less than at present, chartering of overseas ships will have to be continued at a high level, or a considerable tonnage purchased, new or secondhand.

MAINTENANCE OF THE INDUSTRY AND DISPOSAL OF SHIPS

The shipbuilding and ship-engine building industries in Australia have been maintained at a relatively high level since the 1939-45 War by Commonwealth Government policy in—

- owning and operating a shipping line;
- having ships built for its own line, and for charter;
- having ships built for or bought by coastal shipping operators.

The present phase of merchant-ship building in Australia began in 1941 with the estab-

lishment of the Australian Shipbuilding Board. Of the 65 merchant ships built, building and on firm order, since 1941 to July 1952, 59 ships were to the order of the Australian Shipbuilding Board. The other six ships, four of the "Yampi" class and two of the "Chief-tain" class, were built by The B.H.P. Co. Ltd. for its own use and entirely at its own cost. The 59 ships built to order of the Australian Shipbuilding Board are at present (August 1952) disposed as follows—

DISPOSALS OF SHIPS BUILT BY SHIPBUILDING BOARD:

	Total Ordered	In Use	Building	To be Built	Commonwealth Operated	Sold or Ordered (a)	Chartered	Disposal Undecided
	no.	no.	no.	no.	no.	no.	no.	no.
10,000-ton bulk-carrier—								
Motor ..	5	—	—	5	—	—	—	5
Steamship ..	3	—	—	3	—	—	—	3
B.H.P. "Whyalla" class ore-carrier, 10,000 ton, steam-turbine ..	4	—	2	2	—	4	—	—
"A" class 8,500-ton general cargo, steam reciprocating/exhaust turbine ..	13	13	—	—	13	—	—	—
"B" class, and modifications—								
7,000-ton collier, motor ..	1	—	1	—	—	—	—	1
6,400-ton general cargo, motor ..	3	—	3	—	—	—	—	3
6,400-ton general cargo, steam-reciprocating/exhaust turbine ..	8	8	—	—	2	6	—	—
4,750-ton collier, steam reciprocating ..	2	—	1	1	—	—	—	2
"D/A" class, 3,000-ton general cargo, motor ..	2	—	2	—	—	—	—	2
"U/S" class, 3,000-ton general cargo, motor (b)	2	2	—	—	—	2	—	—

"D" class, and modifications—								
2,975-ton general cargo, steam reciprocating ...	9	9	—	—	8	—	1	—
2,475-ton passenger/cargo, motor ...	1	1	—	—	—	1	—	—
"M/M" class, 2,100-ton collier, motor ...	1	—	1	—	—	1	—	—
"E" class, 633-ton general cargo, motor ...	5	5	—	—	4	—	1	—
Totals ...	59	38	10	11	27	14	2	16

(a) Some of the ships were sold after use by Australian Shipping Board (see later).

(b) One of the two ships is not yet completed, but is nearly ready for sea.

It will be seen that of the thirty-eight ships built through the Australian Shipbuilding Board, and in use, twenty-nine are owned by the Commonwealth's operating authority, the Australian Shipping Board, twenty-seven being operated by the authority and two being chartered by it to other coastal operators. If the Commonwealth Government continues to operate a shipping line, it is not unlikely that most of the undisposed sixteen ships of the twenty-one ships now building and on order, at Australian shipyards, will pass to the Government's instrumentality for operation.

Of the fourteen ships sold to and ordered by Australian coastal-shipping operators, eight are in use, one is nearly ready for sea, three are building, and two are yet to be laid down. Six ships, all in use, are of the standard "B" class, a ship of size and type considered to be well suited to general-cargo shipping along the Australian coast; of the six "B" class ships sold to non-government operators four were sold before completion of the ships, and the other two were sold after short use by the Australian Shipping Board. The buyers were McIlwraith, McEacharn Ltd., one ship; Australian Steamships Pty. Ltd., one ship; A.U.S.N. Co. Ltd., one ship; The Adelaide Steamship Co. Ltd., two ships; and Huddart Parker Ltd., one ship. The six ships are used for general-cargo work.

The other eight ships sold and ordered to date are of specific types ordered from the Shipbuilding Board by four operators—Union Steam Ship Co. of New Zealand Ltd., State Shipping Service of Western Australia (a State Government authority), McIlwraith, McEacharn Ltd., and The Broken Hill Proprietary Co. Ltd.

The two general-cargo ships ("U/S" class) ordered by the Union Steam Ship Co., a New Zealand company that has operated on the Australian coast for many years, were the first merchant ships ever built in Australia to the order of a company which is not registered as an Australian company. (Corvettes were built during the war for the Royal Navy and the Royal Indian Navy.)

The Western Australian State Shipping Service ordered a passenger/cargo ship to serve the needs of the Fremantle-intermediate ports-Darwin run operated by the State Shipping Service. An effective and interesting ship for this purpose was achieved by design within the scope of a "D" class hull (building of the ship as a "D" class general-cargo steamship had begun). It is the first sea-going ship ever built in Australia with appreciable passenger accommodation (other than a much smaller ship, the "Governor Blackall", of 838 tons gross, built by Mort's Dock in 1870 for the Queensland Government).

The 2,100-ton collier being built for McIlwraith, McEacharn Ltd. will be used on the one regular run from Newcastle to Sydney.

The four "Whyalla" class ships being built for The B.H.P. Co. Ltd. will be used only for

carriage of The B.H.P. steel-industry group's materials and products (as are the six ships built entirely at the cost of The B.H.P. Co. Ltd., and other ships owned and chartered by the company).

All of the fourteen ships sold and ordered to date have been or will be paid for by the buyers at less than construction cost. In order to encourage the placing of orders in Australia by shipping operators for ships within the scope of the Australian yards, the Commonwealth Government decided in December 1947 to pay portion of the purchase cost of ships from Australian yards built to order or recently commissioned. The portion paid by the Commonwealth varies according to circumstances, but the general intention is to approximate a coastal operator's purchase cost to near the cost of building or securing a similar ship overseas, provided the portion to be paid by the Commonwealth does not exceed 25 per cent. At late 1947 shipbuilding costs in the United Kingdom, the usual source of ships ordered overseas from Australia, was about 25 per cent. less than in Australia; by mid-1952 the U.K. advantage had risen to about 33 per cent.

To qualify for such assistance the coastal operator is required to place the order with the Australian Shipbuilding Board, which originates designs—original or as specified, establishes specifications in conjunction with the operator, calls for tenders from the Australian shipbuilders for the hull building and fitting out and from Australian and overseas engineers for the main engines, boilers and auxiliary equipment, etc., and places the order or orders. For most of the ships now in use and secured with Commonwealth assistance the operator is required to keep the ship on the Australian coastal use for five years; recently, the period was increased to ten years.

There is a sizable Customs protective tariff imposed on dredges and on ships not exceeding 500 tons gross. Ships larger than 100 tons gross, and ships not larger than 500 tons gross on which a bounty would not be paid if built in Australia, are admitted free of tariff. However, a Customs Prohibited Imports regulation provides that ships cannot be imported from abroad without approval of the Minister for Shipping and Transport; in addition, because of general imports restrictions (see Appendix II), the ordering of ships abroad is subject to the general control of imports.

Fifteen new merchant ships have been ordered abroad in recent years; all are to be built in the United Kingdom. Four of the ships are to the order of the Commonwealth Government; these ships are required as quickly as possible, and the Australian shipyards could not deliver quickly enough because of work in progress. The other eleven ships were to the order of non-government shipping operators in Australia, some having been ordered after the Commonwealth Government had decided to assist coastal shipping operators to purchase Australian-built ships. The type and size of the fifteen coastal ships, and the ships delivered, are as follows—

SHIPS BUILT OR BUILDING ABROAD:		1946-1952
DELIVERED—		deadweight tonnage
Motorship, refrigerated and general cargo	...	5,500
Motorship, passenger and general cargo	...	5,000
Steamship (reciprocating), collier	...	3,000
Motorship, general cargo	...	2,150
Motorship, general cargo	...	1,500
Motorship, general cargo	...	700
Six ships delivered	...	17,850
TO BE DELIVERED—		
Steamships (reciprocating), bulk carriers—two each of 10,000 tons (a)	...	20,000
Motorships, timber carriers—two each of 1,650 tons (a)	...	3,300
Motorship, general cargo	...	5,500
Motorship, general cargo	...	4,500
Motorship, collier	...	1,900
Motorship, general cargo	...	1,450
Motorship, general cargo	...	1,440
Nine ships to be delivered	...	38,090
Total, fifteen ships built or building abroad	...	55,940

In addition, several new tugs have been delivered from abroad; and two pilot ships of 800 tons and 677 tons, four tugs, two dredges and seven hopper barges are on order abroad.

The table set out below compares the origin and operation categories of new merchant ships built or ordered during the years 1941-1952, in Australia and overseas for Australian coastal shipping. The statistics emphasise the significance to Australian shipbuilding and ship-engine building of the Commonwealth-owned shipping line and The B.H.P. shipping line—

OPERATION OF NEW SHIPS:		Built, Building or Ordered 1941-1952
AUSTRALIAN-BUILT—		no. deadweight tonnage
Commonwealth Government owned	29	153,400
The B.H.P. Co. Ltd.	10	106,180
Coastal operators other than the Commonwealth Government and The B.H.P. Co. Ltd.	10	45,940

DRY DOCKING, AND REPAIR, etc., OF SHIPS

From necessity the cleaning and repair of ships became well established early in Australia's history. The great distances in miles and time of Australia ports from overseas home ports required such facilities, and the great dependence of Australia on coastal shipping soon developed the coastal fleet to a size that sustained the ship-maintenance industry.

The port of Sydney now has, reputedly, the largest and best facilities in the Southern Hemisphere for ship maintenance. Requirements of the 1939-45 War helped in this, as the war brought about, or hastened, the establishment at Sydney Harbour of a graving dock with capacity to dock the largest ships in the world. While intended primarily for naval purposes, the dockyard is available for the docking of large merchant ships that cannot be conveniently docked elsewhere in the port, which has four other graving docks. One of these docks, the "Woolwich" dock, is the largest privately-owned dock in the Southern Hemisphere. (See Part One for sizes of docks.)

The existence at Sydney Harbour of "all-round" ship-maintenance establishments means much to the service provided. This, together with the natural attributes of the harbour as a "harbour" for a great amount of shipping at one time, lead to a relatively enormous demand being made during the war for facilities there, resulting in considerable expansion in facilities and widening of experi-

Undisposed ships building or to be built		16	121,700
Totals, Australian-built ships	...	65	427,220
OVERSEAS BUILT (a)—			
Commonwealth Government order	4	23,300	
Orders of all other coastal operators	11	32,650	
Totals, Overseas-built ships (a)	15	55,950	
Totals, Australian and Overseas	80	483,170	

(a) See previous table.

The building of merchant ships is the mainstay of a shipbuilding industry. It is obvious that the industry in Australia, to maintain itself reasonably close to its present status (naval shipbuilding could fall away), will remain almost entirely dependent upon Commonwealth Government policy in encouragement and maintenance of Australian shipping and shipbuilding. Only an industry (including engine building) of reasonable size—which is beyond that sustainable by peacetime naval building in Australia—could maintain skill and development in itself in several places, and among its suppliers in other industries.

Probably the best that the industry could expect is that, in the long run, it supplies the greater part of merchant-ship additions and replacements for Australian coastal shipping, particularly cargo ships. (Australia is a country particularly dependent upon its coastal shipping for economic transport of basic, bulk raw materials and many items of general cargo from originating State to using State.) The industry requires about 36,000 deadweight tons a year for economic operation, enabling it to maintain staff and skill by regular occupation. The present rate of production is only about 24,000 deadweight tons a year; the capacity of the shipyards best placed to continue as regular shipbuilders is at maximum—fully staffed and fully occupied—about 90,000 deadweight tons a year.

Many large ships, naval and merchant, some of them the largest of their type in the world, were repaired and/or converted at Sydney. War-damage repairs were considerable and of wide variety, and were completed at speed. Wartime work at other ports were extensive, particularly at Brisbane and Newcastle, but much less than at Sydney. From 1942 to 1946, 12,160 ships, totalling about 53 million tons, were converted or repaired in Australia, including major repairs which before 1942 would have been beyond the capacity of Australian shipyards.

After the war the industry carried out the complete re-conversion to peacetime use of coastal passenger/cargo ships that had been converted to troop carriers or armed merchantmen. This was mostly done at Sydney.

The port of Melbourne lacks an "all-round" ship-maintenance establishment based on a floating or graving dock big enough to take all ships using the port other than, perhaps, a few of the largest, such as some of the overseas passenger liners. Unlike the port of Sydney, the port of Melbourne (which handles the greatest tonnage of overseas and interstate shipping of any Australian port) has insufficient docking capacity for large ships. A naval graving dock is usually unavailable for docking of merchant ships, and the remaining large dock is at times unable to

cope with the demand. Further, neither dock is large enough for many of the ships using the port, including some for which Melbourne is the home port. At times ships requiring emergency attention, but too large for the Melbourne docks, have to be sent to Sydney, occasionally in tow. There is no large graving or floating dock at other ports of southern Australia, and consequently there is no suitable dock between Sydney and Durban and Singapore for many of the large ships approaching and leaving Australia along the southern coast.

Provision has been made in planning for improvement of the port of Melbourne for a large graving dock to be built, but no firm steps have been taken to that end.

The "feast or famine" conditions that so frequently exist for ship-maintenance organisations make it difficult to assess whether or not there is sufficient participation in the activity in Australia. The shipowners, too, help themselves considerably in maintenance

work, by operating maintenance establishments. It is likely, however, that any persisting inadequacy of ship-maintenance service would attract attention from, in particular, general-engineering firms seeking to extend their fields of activity. A probable hindrance to such extension would be a shortage of experienced engineers capable of organising and supervising ship repairs, etc., at the speed sought by ship-owners anxious to get ships to work and out of expensive idleness, and, if Lloyd's rating is to be retained, to the standards required by the surveyors of Lloyd's Register of Shipping.

Spare Parts

Lloyd's Register of Shipping recommends the essential spares which ships on its register should carry. In general, parts for engines, auxiliary equipment, deck equipment, etc., are produced in the engineering shops catering for ship-repair work, for replacement of worn parts and to restore ships' spares. The capacity for this service appears adequate.

SMALLCRAFT

Boat building and maintenance has been established in Australia since shortly after the origin of white settlement in the country. This applied not only for fishing boats, but also for ketches, schooners, etc., required for trading along the coasts and coastal rivers. Later, many small steamboats were built, including paddle-steamers for the large inland rivers such as the Murray and the Darling. Luggers for northern Australian and island trade were built in considerable number. Finally, sporting and pleasure craft became a commonplace.

During the 1939-45 War the demand for smallcraft for auxiliary purposes to the Armed Services engaged in the Pacific theatre of war became enormous and urgent. These included craft as large as ocean-going motor-lighters and "Fairmile" high-speed launches. Altogether, many thousands of 162 types of smallcraft were built, mainly of wood. To meet this need, special boatyards were established at various ports, and a large engine-building programme was entered into. Three types of diesel engines were produced, including about 290 200-h.p. six-cylinder engines—the largest engine programme ever attempted and carried out in Australia—and about 140 170-h.p. diesel engines. A few 100-h.p. diesels were also built.

The smallcraft industry, enlarged for such a demand, fell away quickly after the war.

PRODUCTION:

	1947-48		1948-49		1949-50	
	no.	£	no.	£	no.	£
Small boats of under 5 tons gross	704	128,404	(a)	155,858	1,244	148,292
Wooden vessels	90	464,166	121	230,232	59	156,413

(a) Not available for publication.

Boat builders in Australia have been endeavouring to develop an export market in East Asia, the Pacific Islands and the U.S.A. The largest boatbuilder has exported pleasure craft of up to 60 feet in length to the U.S.A. and also engine parts and spares to the Pacific Islands. Exports of boats, launches and yachts in 1949-50 totalled 1,681 in number, valued at £22,796, compared with 294 valued at £247,700 in 1948-49. These latter figures included disposals of surplus warstocks. Total export of

Few of the specially established boatyards continued as such. One in Sydney is well placed and has maintained itself on a variety of woodworking work.

The boatbuilding industry suffered a further setback when sales-tax on goods considered to be of luxury types was substantially increased as the result of adoption of the 1951 Commonwealth Budget. This caused the selling prices of sporting and pleasure craft to rise considerably, and the demand fell away to a low level. This position has persisted, and consequently, the capacity for the building of smallcraft in Australia is much larger than present demand.

Although practically all timbers suitable for boat building are available in Australia in their natural state, the industry has experienced difficulty in obtaining timber cut to sections and lengths suitable for boat construction, as most timber mills are concentrating on cutting housing timbers. The position improved in 1952. The overall availability of indigenous timbers suitable for boatbuilding is diminishing, however, as the natural resources were never considerable and the main species have been heavily cut beyond replacement rate.

Production of smallcraft in the years 1947-48, 1948-49 and 1949-50 was as follows—

vessels other than the above group amounted to 15 in number valued at £16,404 in 1949-50, compared with 53 valued at £85,093 in 1948-49. Imports of boats for 1949-50 totalled 68 in number, valued at £25,423. This represents an increase of about £21,000 in value over the previous year.

Generally it would seem that the Australian boat-building industry can compete successfully both in price and quality with overseas manufacturers.

Part Three: Basic Statistics

COMPARATIVE STATISTICS, 1938-39/1949-50

NUMBER OF ESTABLISHMENTS AT 1938-39 AND 1949-50

NUMBER OF EMPLOYEES AT 1938-39, 1949-50, JUNE 1950, SEPTEMBER 1951

Activity (Statistical Sub-classes used by Commonwealth Statistician, 1949-50)	Establishments		Employees			
	1938-39	1949-50	1938-39	1949-50	June 1950 (a)	Sept. 1951 (a)
	no.	no.	no.	no.	no.	no.
Motor Vehicles and Motor Cycles—						
Construction and Assembly (b)	(c)89	72	(c)4,279	11,357	10,889	12,373
Motor Bodies (d)	(o)232	(o)476	(o)11,742	(o)16,168	16,532	16,890
Repairs (e)	(f) (j)3,143	(j)4,649	f) (j)18,581	(j)35,228	29,632	31,347
Motor Accessories (g)	(h) (j)72	(j)133	(h) (j)1,919	(j)5,121	5,737	6,515
Cycles (Foot and Hand-driven) and Accessories (k)	(l)	116	(l)	1,303	1,125	1,126
Horse-drawn Vehicles (m)	(n) (o)249	(o)128	(n) (o)900	(o)471	362	380
Tramcars and Railway Rolling Stock (p)—						
Government and Municipal	117	127	27,310	38,432	38,762	37,989
Other	9	14	1,699	1,942	1,212	1,242
Ship and Boat Building and Repairing, Marine Engineering—						
Government	5	11	1,558	5,039	5,371	5,326
Municipal and Other	89	201	4,107	10,623	10,623	10,013
Aircraft (q)	17	49	1,189	11,590	10,617	11,900
Other (of transport group, Class IV) (r)	12	11	127	144	154	173
Totals (s)	4,034	5,987	73,411	137,418	131,016	135,334

STATISTICAL SUMMARY, 1949-50

EMPLOYMENT, MALE AND FEMALE

SALARIES AND WAGES PAID, IN TOTAL AND PER PERSON ENGAGED

VALUE OF PRODUCTION

VALUE OF MATERIALS, POWER, FUEL, REPAIRS, etc.

VALUE OF OUTPUT

See Explanations,
Appendix IV

Activity (Statistical Sub-classes used by Commonwealth Statistician, 1949-50)	Employment			Salaries and Wages Paid		Value of Pro- duction	Value of Materials, Fuel, etc. Used	Value of Output
	Males	Females	Persons	Total	Per Person Engaged			
	no.	no.	no.	£'000	£	£'000	£'000	£'000
Motor Vehicles and Motor Cycles—								
Construction and Assembly (b)	10,591	766	11,357	5,903	520	10,833	4,904	15,737
Motor Bodies (d) (o)	15,258	910	16,168	7,547	466	10,328	11,591	21,919
Repairs (e) (j)	32,601	2,627	35,228	12,861	365	20,098	14,278	34,376
Motor Accessories (g) (j)	3,958	1,163	5,121	2,375	464	3,831	2,550	6,381
Cycles (Foot and Hand-driven) and Accessories (k)	1,158	145	1,303	426	327	673	832	1,505
Horse-drawn Vehicles (m) (o)	450	21	471	138	293	243	141	384
Tramcars and Railway Rolling Stock (p)—								
Government and Municipal	38,231	201	38,432	18,057	469	21,643	11,632	33,275
Other	1,869	73	1,942	871	448	1,123	948	2,071
Ship and Boat Building and Repairing, Marine Engineering—								
Government	4,890	149	5,039	2,509	497	2,700	1,122	3,822
Municipal and Other	10,404	159	10,623	5,425	511	6,754	3,418	10,172
Aircraft (q)	10,709	881	11,590	5,661	488	6,851	3,964	10,815
Other (of transport group, Class IV) (r)	126	18	144	70	486	138	204	342
Totals (s)	130,305	7,113	137,418	61,843	450	85,215	55,584	140,799

Explanatory Footnotes to Both Tables

- (a) These employment figures are taken from monthly payroll-tax returns and differ slightly from the other employment figures, which are supplied on annual factory returns.
- (b) Does not include body building.
- (c) At 1938-39 the then sub-class "Motor Vehicles and Cycles—Construction and Assembly" included motor cars and trucks, motor cycles, and cycles. Establishments in South Australia classifiable in the sub-class were in 1938-39 included in the sub-class "Motor Vehicles and Cycles—Repair".
- (d) Also includes panel beating, trimming, etc., and similar repairing; and manufacture of motor-cycle side-cars.
- (e) Principally mechanical repairs; includes body repairing where associated as a lesser activity with mechanical repairing.

- (f) At 1938-39 the then sub-class "Motor Vehicles and Cycles—Repairs" included repairs to motor cars and trucks, motor cycles, and cycles. (See also footnote (c) above.)
- (g) Also includes the manufacture of automotive electrical parts and accessories.
- (h) At 1938-39 the then sub-class "Cycle and Motor Accessories" included the manufacture of parts and accessories for motor cars and trucks, motor cycles, and cycles.
- (j) Establishments in Tasmania classifiable within the sub-class "Motor Accessories" were included in the sub-class "Motor Vehicles—Repairs".
- (k) Also includes parts manufacture; repairs; and tricycles (for cripples, etc.).
- (l) At 1938-39 the manufacture of cycles, cycle parts and cycle accessories was included with manufacture of motor cars and trucks and motor cycles, and parts and accessories for such vehicles (see footnotes (c), (f) and (h) above).
- (m) Also includes repairs.
- (n) At 1938-39 the then sub-classes "Horse-drawn Vehicles" and "Spokes, Felloes, etc." made up the present sub-class "Horse-drawn Vehicles" (which includes repairs).
- (o) Establishments in Tasmania classifiable within the sub-class "Horse-drawn Vehicles" were included in the sub-class "Motor Bodies".
- (p) Also includes locomotives.
- (q) Also includes engine manufacture, and frame and engine parts and accessories.
- (r) The sub-class "Other" is one of miscellaneous activities not elsewhere included in the construction and repair of vehicles group of the Commonwealth Statistician's Class IV, "Industrial Metals, Machines, Conveyances". The sub-class includes hand-trucks, hand-trolleys, wheelbarrows, etc. (all except one of the establishments so classified being in New South Wales).
- (s) Consideration and comparison of totals must take into account the effects stated in footnotes explaining the composition of certain sub-classes and figure units.

Chapter 11:

**ELECTRICAL AND ELECTRONIC
PRODUCTS**

Part One: Structure of Established Manufacturing Activities

THE manufacture of electrical and electronic products—wire and cables, machines, appliances, lamps, telephone and telegraph apparatus, radio and other electronic apparatus and recording apparatus—is established in Australia as listed below, the extent of association of activities being shown by annotation throughout. The listing is intended to be reasonably indicative, but not necessarily fully inclusive of all products made.

In 1949-50 there were 940 and in 1948-49 927 establishments wholly or mainly engaged in manufacture of electrical and/or electronic products (not including X-ray equipment—see Chapter 12, "Machinery, Plant, Equipment, Apparatus, Not Elsewhere Included"). Of the 927 establishments in 1948-49, 509 each employed up to 10 persons, 144 each from 11 to 20 persons, 150 each from 21 to 50 persons, 50 each from 51 to 100 persons, and 74 each more than 100 persons. Five establishments engaged wholly or mainly in making electrical products, and three establishments engaged wholly or mainly in making radios and associated electronic apparatus, each employed more than 750 persons; the 8 establishments collectively employed about 9,500 persons, out of the total of 39,436 persons engaged in the electrical and electronic products industries. The more-than-100 persons group of establishments employed 26,583 persons, the more-than-50 group 30,209 persons, and the not-more-than-50 group 9,227 persons.

Manufacturing activities in the electrical and electronic industries in Australia are dealt with in this study in the following sequence—

ELECTRICAL-ENGINEERING INDUSTRY—

- Wires and Cables
- Machines and Apparatus
- Appliances
- Lamps (including Fluorescent and Neon Tubes)

COMMUNICATIONS-ENGINEERING INDUSTRY (INCLUDING ELECTRONICS ENGINEERING)—

- Radio and Electronic Apparatus Otherwise
- Telephone and Telegraph Apparatus
- Recording Apparatus

ELECTRICAL-ENGINEERING INDUSTRY

Of the 927 establishments engaged in manufacture of electrical and electronic products in 1948-49, 791 were classified as being wholly or mainly with the electrical-engineering industry, including manufacture of telephone and telegraph apparatus and recording apparatus (which for convenience of arrangement of activities are grouped in this study within communications engineering—see later). Of the 791 establishments of the electrical-engineering group 432 each employed up to 10 persons, 129 each from 11 to 20 persons, 127 each from 21 to 50 persons, 46 each from 51 to 100 persons, 29 each from 101 to 200 persons, 9 each from 201 to 300 persons, 7 each from 301 to 400 persons, 6 each from 401 to 750 persons, and 6 each more than 750 persons. The 6 largest establishments employed 7,074 persons out of the industry total of 30,025 persons. The more-than-300 group employed 12,611 persons, the 101-to-300 group employed 6,166 persons, and the less-than-100 group employed 11,248 persons.

WIRES AND CABLES: There are fourteen manufacturers of one or more types of electrical and communication wire and cables in Australia (as far as is known at present—April, 1952). Most of the companies are concerned only with that activity. The structure of the activity set out below shows that certain of the major companies are associated with one another. (See Chapter 9, "Metals, Shapes, Pipes, Tubes, Castings, Forgings", for comment—"Company Organisation and Association Within the Ferrous and Non-ferrous Metals Industries in Australia"—on association between non-ferrous mining companies, non-ferrous smelting and refining companies, non-ferrous rolling, extrusion, etc., companies, and certain electrical and communications wires and cables companies.) For the purposes of this study, wire and cable manufacture in Australia is divided into three categories: Stranded Aerial Conductors; Paper-insulated Cables; and Cables and Wires Otherwise. The range of wires and cables made in Australia for electrical, electronic and telecommunication purposes is extensive. Within the near future, paper-insulated power-mains cables will also be made, but high-voltage mains-cables of the pressure type (oil-filled, gas-filled, gas-compression, impregnated) will probably not be made in Australia for some years, the quantity required being insufficient to justify such manufacture. Wire and tape for electrical resistance and heating, and wire for filament lamps and electronic valves, are not made in Australia.

Stranded Aerial Conductors

Metal Manufactures Ltd. operates two plants, one each at Port Kembla, N.S.W., and Maribyrnong, a suburb of Melbourne, Vic. The company is the principal copper fabricator in Aus-

tralia and is mainly engaged in that activity. (Five member companies of the Cable Makers Association of England are each shareholders in M.M. Ltd.) The company draws the major portion of its copper market shapes from overseas, and the remainder from an associated company, The Electrolytic Refining and Smelting Co. of Australia Pty. Ltd., Port Kembla, N.S.W. M.M. Ltd. is the only manufacturer in Australia of wire from the wire-bar stage, in copper and cadmium copper; the wire is drawn to all usual gauges and to wire-rod gauge and other gauges for redrawing elsewhere. The company is the only manufacturer of steel-cored aluminium stranded conductor, and is the principal manufacturer of other stranded bare conductor in copper, cadmium copper, and aluminium. Trolley-wire (grooved and round) is another product made only by M.M. Ltd. (The company is also the only maker in Australia of copper and brass tubing, and rolled copper rod.) Other wires and cables made by M.M. Ltd. are bare hard-drawn aerial wire; tinned wire (including fuse wire); winding wires and strip (not enamelled) covered with cotton, silk, glass or paper; and braided aerial cable and plastics-covered aerial cable. The complete range of products is made at the Port Kembla plant; and wire (from wire-rod stage), strand, and copper and brass tubing, are made at the Maribyrnong plant.

International Radio Co. Pty. Ltd., East Sydney, N.S.W., makes stranded aerial conductor as part of wider activities, drawing its wire from the wire-rod stage; and has a capacity of 4,800 tons a year of all sizes of bare hard-drawn stranded copper wires and cables, also single end wires and cables in all sizes. (See below, "Cables and Wires Otherwise".)

Paper-insulated Cables

Austral Standard Cables Pty. Ltd. operates two plants, one each at Port Kembla, N.S.W., and at Maribyrnong, a suburb of Melbourne, Vic., for manufacture of paper-insulated lead-covered tele-communication cable; cables up to 1,500 pairs have been made. The company also makes enamelled-insulated, textile-covered, cable lead-sheathed for terminating and internal distribution cable and cotton braided for switchboard cable, and also, from time to time, co-axial carrier cable. All wire is obtained in ready-to-use gauges, bare and enamelled. (A.S.C. Pty. Ltd. is owned in equal partnership by Metal Manufactures Ltd. and Standard Telephones & Cables Pty. Ltd. Consideration is being given to erecting a third A.S.C. plant, at Liverpool, N.S.W., for manufacture of P.V.C.-insulated and sheathed indoors-distribution telephone cable up to 50 pairs.)

(**British Australian Power Cables Pty. Ltd.** is establishing a plant, at Port Kembla, N.S.W., for manufacture of paper-insulated power-mains cables, lead-covered and aluminium-covered. Production is expected to begin in 1952. The company is owned in partnership by Metal Manufactures Ltd. and British Insulated Callender's Cables Ltd., U.K. The latter company is a member company of the Cable Makers Association of England, and is a large shareholder in Metal Manufactures Ltd.)

(**Fairfield Cables Pty. Ltd.** is to establish a plant at Fairfield, a suburb of Sydney, N.S.W., for manufacture of paper-insulated lead-covered power-mains cables, stranded bare conductors, and enamelled and covered winding wires. A factory site has been prepared. Wire will be drawn from the wire-rod stage. Production is expected to begin before 1955. Three United Kingdom cablemakers have formed a partnership owning the company—Enfield Cables Ltd., W. T. Henley's Telegraph Works Co. Ltd., and Liverpool Electric Cable Co. Ltd. Those three companies are among the seventeen member companies of the Cable Makers' Association of England, which in equal interest with Metal Manufactures Ltd. owns Cable Makers Australia Pty. Ltd.)

Cables and Wires Otherwise. Regular grades of electrical and radio cables made in Australia extend from 6-volt to 11,000-volt single and multiple conductor. — Insulation of conductor and sheathing and filling of cables are in overall production, principally of rubber (V.I.R. insulation of conductor, and tough rubber filler and sheath), but synthetic plastics material, mainly polyvinyl-chloride, is now considerably used, particularly for grades up to 660-volt, and for insulation tubing; varnished cambric, asbestos, glass and polyethylene are insulants used for specific-purpose cables and insulating material. — Insulated cables are produced for general-purpose domestic and workshop wiring, including flexibles and flexible cords, unkinkable cable, aerial covered cables (including service-entrance cable). Specific-purpose electrical cables include those for motor vehicles, aircraft, trains and ships, including Armed Services specifications; radio wiring and other cables, including co-axial and twin-conductor; dynamo flexibles; high-tension; lift-control; neon-sign; railways signal and signalling; trailing, including conductive rubber earth screened and cored. — Construction includes, in variety of combination for purpose of cable, twisted, side-by-side, cradled, wormed, filled, taped (fabric and metal), braided (fabric and metal), varnished, compounded, served (including weatherproofed, flame-proofed, etc.), bedded, lead-alloy sheathed, armoured. — Telecommunication cables made in Australia other than paper-insulated cable (see above) are enamel-insulated textile-covered lead-sheathed armoured for outdoor distribution feeders, e.i.t.c. lead-sheathed for terminating cable and internal distribution, e.i.t.c. braided for switchboard cables, plastics-insulated (usually P.V.C.) for jumper wires and small pair telephone indoor distributing cables, and telephone instrument and switchboard flexible cords. — Wires made in Australia include grooved and round trolley-wire, hard-drawn aeriels, tinned wire (including fuse), bare flexible twists and braids, tinsel conductor cordage, and winding wires insulated with oleoresinous enamels, synthetic enamels, cotton, silk, rayon, glass, light paper. Manufacturers of cables and wires are engaged as follows—

Austral Standard Cables Pty. Ltd. makes telecommunication cables—terminating, internal distribution, switchboard, carrier co-axial. See "Paper-insulated Cables", above, for detail.

A.W.A. Telcon Pty. Ltd. operates one plant, at Tamworth, N.S.W., for manufacture of plastics-insulated cables for radio and electronic wiring, low-tension automotive wiring, subscribers' premises telephone wiring, and co-axial cable for carrier and radio frequency. All wire is purchased in ready-to-use gauges. (The company is principally owned by two companies—Amalgamated Wireless (Australasia) Ltd., one of the largest radio-equipment manufacturing companies in Australia, and The Telegraph Construction and Maintenance Co. Ltd., U.K. T.C. & M. Co. Ltd. is a member company of the Cable Makers Association of England.)

A. F. Bambach Pty. Ltd. operates two plants at Sydney, N.S.W., for manufacture of litzendraht wire; silk-covered and cotton-covered winding wires and strip; bare flexible twists and braids; bare hard-drawn aerial wire; telephone instrument and switchboard cords (from imported tinsel cordage, though this company does not manufacture tinsel); and cables made to specification, as a lesser activity. Portion of wire requirements are drawn from re-drawing wire, and wire is rolled to strip. All enamelled wire is purchased ready to use.

Bly's Industries Pty. Ltd. operates two plants, one at Rosebery and one at St. Leonard's, both suburbs of Sydney, N.S.W., for manufacture of tinsel conductor cordage, and covered cords therefrom (and, as the principal activity, the manufacture of steel wool, pot mits, pot scourers, filter mesh and metal wool). The company draws and rolls its wire down to tinsel ribbon from local and imported re-drawing wire, makes up the tinsels and tinsel cordage for its own use and for sale, and does P.V.C. sheathing and cotton braiding of tinsel cordage for telephone instrument cords, switchboard cords, and other very flexible conductors, including low-voltage power conductors.

Cable Makers Australia Pty. Ltd. operates a plant at Liverpool, N.S.W., for the manufacture of insulated cables (other than paper-insulated), of which the company is one of the two largest manufacturers in Australia. It also makes its own rubber di-electric and sheathing compounds. It obtains its copper requirements from Metal Manufactures Ltd., and draws the wires to the required sizes. The company makes all sizes and types of rubber-insulated, plastics-insulated, and varnished-cambric cables for domestic and industrial purposes, from the low-voltage to the high-tension range. Types included are all classes of Admiralty patterns, Air Force and Army Cables; trailing cables, principally for mining; control and signal cables. Under licence from the Rockbestos Corporation of America, the company manufactures a wide range of asbestos-covered cables. Cable Makers Australia Pty. Ltd. is owned with approximately equal interest by Metal Manufactures Ltd. and members of the Cable Makers Association of England.

Conqueror Cables Pty. Ltd. operates one plant at Annandale, a suburb of Sydney, N.S.W., for the manufacture of insulated cables. The range manufactured includes automotive and aircraft cables; switchboard cables; glass-covered and asbestos-covered heat-resisting cables; multi-core communication cables; a large variety of copper braids and flexible twists; cotton-braided and glass-braided sleeveings, etc. A major activity is the assembly of wiring harnesses for motor vehicles and the company is the foremost in Australia in this particular field. The company purchases most of its copper wire in ready-to-use gauges.

Insulated Wire (Aust.) Pty. Ltd. operates one plant, at Villawood, a suburb of Sydney, N.S.W., for the enamelling of wire in oleoresinous and synthetic grades for winding wires. The company draws some of its wire from re-drawing wire, and purchases the remainder in ready-to-use gauges. (The company is owned by a partnership of Australian General Electric Pty. Ltd., one of the largest companies making electrical machines and equipment in Australia (and itself jointly owned by General Electric Inc., U.S.A., and Associated Electrical Industries Ltd., U.K.), and British Insulated Callender's Cables Ltd., U.K. See also British Australian Power Cables Pty. Ltd., above.)

International Radio Co. Pty. Ltd. operates one plant, at East Sydney, N.S.W., for the manufacture of stranded aerial conductor, bare aerial wire, bare earth wire and soft binding wires, tinned shop cables and flexibles up to 660-volt, switchboard panel wires, service-entrance cables, asbestos-covered range and asbestos-roved and cotton-braided heater cables and flexibles, high-tension power cables up to 11kV, neon-sign cables (polyethylene and P.V.C. insulant), radio and electronic wiring cables, co-axial radio-frequency cables, telephone cables, one-pair and two-pair jumper wires. All wire is drawn from wire-rod which is mostly imported. Manufacture of radio components—radio-valve sockets, valve plugs, valve shields, microphone connectors—is also a major activity.

Jacoby, Mitchell & Company Pty. Ltd., in conjunction with **Beacon Cables**, operates a plant at Five Dock, a suburb of Sydney, for the manufacture of communication cables, including enamel-insulated textile-covered, lead-sheathed, up to 25 pairs, for internal-distribution cables. They also manufacture similar cables armoured for outdoor underground feeder cables, and e.i.t.c. braided switchboard cables, and are contractors to the P.M.G.'s and other Government Departments. This company is also a merchant and importer of electronic measuring and testing equipment and a manufacturer of household electrical appliances.

Laurel Winding Works operates one plant at Dulwich Hill, a suburb of Sydney, N.S.W., for covering of purchased bare and enamelled wire to produce cotton-covered and silk-covered

winding wires, fine resistance wires mainly. Steel wire is also covered, for use by manufacturers of millinery and artificial flowers.

Metal Manufactures Ltd. produces tinned wire (including fuse wire); winding wires and strip, not enamelled, covered with cotton, silk, glass, or paper; and plastics-covered aerial cable and braided aerial cable. (See Stranded Aerial Conductors, above.)

Nylex Cables Pty. Ltd. operates one plant, at Lilydale, near Melbourne, Vic., for the manufacture of plastics-insulated cables, mainly P.V.C., with plastics or braided sheathing. The company is one of the largest producers of plastics-insulated cables in Australia, specialising in that field with a wide and extending range including in addition to domestic and workshop cables up to 660-volt, those for telephone jumper wires, subscribers'-premises telephone wiring (small pair cables), and radio wiring. All wire is purchased in ready-to-use gauges. (The company is a wholly-owned subsidiary of Moulded Products (Australasia) Ltd., the largest plastics-products company in Australia. The parent company supplies the cable company with P.V.C. and polyethylene, which it compounds for various purposes. Flexible insulation tubing is produced by a subsidiary company specialising in extrusions.)

Olympic Cables Ltd. operates one plant, at Footscray, a suburb of Melbourne, Vic., for manufacture of insulated cables (other than paper-insulated), of which the company is one of the two largest manufacturers in Australia. The company also makes enamelled (oleoresinous and synthetic) and textile-covered winding wires. The range of cables regularly made includes all types stated above (see introduction to this section) other than co-axial, and includes telephone terminating and indoor distributing cables up to 200 pairs, and switchboard cables. Insulation and sheathing are principally of rubber, with plastics insulation and sheathing being extended, mainly P.V.C. The company draws all its copper wire, from 10-gauge wire purchased from Metal Manufacturers Ltd. and imported. (Olympic Cables Ltd. is associated with Olympic Tyre & Rubber Co. Ltd., Footscray, Vic., one of the largest manufacturers of tyres and tubes in Australia.)

Rola Co. (Aust.) Pty. Ltd. operates one plant, at Richmond, a suburb of Melbourne, Vic., for manufacture of loud-speakers (principal manufacturer in Australia); winding wires; litzendraht wires; magnet alloys, and permanent magnets for varied uses; and radio transformers and chokes. The company is the principal producer in Australia of winding wires, including oleoresinous enamel, synthetic enamel, textile covered, light paper covered. The company draws all its wire, from re-drawing wire.

MACHINES AND APPARATUS: Some of the firms engaged in manufacture of electric machines and apparatus concentrate their activities on a particular article. The majority, however, make a range of products, whilst three large companies, either in their own factories or through subsidiary and/or associate companies manufacture a wide range of electrical apparatus. One of these companies, in three establishments, makes transformers, switch gear, electric motors (including traction types), motor starters and controllers, domestic appliances and fluorescent lighting auxiliaries; this company is also associated with the manufacture of winding wire. One group of associated companies is a major manufacturer of porcelain for electrical purposes, and also produces switchgear, transformers, motors, and electric appliances, and owns and controls a radio broadcasting station. (For X-ray equipment, see Chapter 12.) Activities within the electrical machines and apparatus industry are as follows—

Alternators and Generators

There are five principal manufacturers of alternators in Australia, four of which also make generators. In addition, some other electrical firms will at times make alternators if they have the orders and/or the capacity. **The English Electric Co. Ltd.**, associated with a United Kingdom firm, makes alternators to order, and also makes transformers and motors. — **K.L. Electric Pty. Ltd.** makes alternators of up to 45kVA capacity, and generators up to 30 kW, and also makes motors. — **Machining and Electrical Co. Ltd.** makes alternators up to 45 kVA and generators up to 50kW, and also makes motors. — **Standard Waygood Ltd.** makes alternators up to 45 kVA and generators up to 100 kW (to special order) and also makes transformers, switchgear, lifts, escalators and motors. — **G. G. Martin Ltd.** makes alternators up to 30 kVA and generators up to about 5 kW, and also makes transformers, welding equipment, starters and controllers, motors. — The manufacture of generators is undertaken by about 12 other firms, about 6 of which also make electric motors.

Motors

There are about 30 manufacturers of electric motors. About 6 of these make both A.C. and D.C. motors, about 20 make only A.C. motors (including 7 manufacturers of fractional-horsepower motors only) and four firms make only D.C. motors. **The English Electric Co. Ltd.** (see "Alternators and Generators") make A.C. motors up to 300 h.p. (to order). — **Australian General Electric Pty. Ltd.** associated with British Thomson-Houston, U.K., and General Electric Corp., U.S.A., one of the largest Australian electrical companies, makes A.C. motors up to 500 h.p., and also makes power transformers, high tension switchgear, selenium rectifiers, and a wide range of electrical appliances. — **Crompton Parkinson Ltd.** makes A.C. motors up to 125 h.p., and also makes power distribution transformers. — **K.L. Electric Pty. Ltd.** (see "Alternators and Generators") makes A.C. motors up to 25 h.p. and D.C. motors up to 45 h.p. — **G. G. Martin Ltd.** (see "Alternators and Generators") makes A.C. motors up to 15 h.p. — **McColl Electric Works Ltd.** makes A.C. motors up to 25 h.p. and D.C. motors up to 6 h.p., and will also make small alternators and generators. — **Lincoln Electric Co. (Aust.) Pty. Ltd.**, a subsidiary of a U.S.A. company, makes A.C. motors up to 25 hp., and is also an important manufacturer of

welding equipment. — **Durst Electric Motors Ltd.** makes A.C. and D.C. motors up to 10 h.p., and also makes grinders and polishers. — **H.E. Brehaut Ltd.** makes A.C. motors up to 15 h.p., and also makes grinders and polishers. — **Pope Products Ltd.**, an important manufacturer of hand tools, plumbers' brassware, domestic products of wide range, also operating a hot-brass pressing shop (see Chapter 9), makes A.C. motors up to 10 h.p. — **Atom Electrical Manufacturing Co.**, a small electrical engineering factory in Qld., has made large A.C. motors and also generators and alternators. — **Standard Waygood Ltd.** (see "Alternators and Generators") makes A.C. and D.C. motors, but mainly only for its own use. — **Six other companies** make A.C. motors in varying ratings up to 5 h.p.; two of these also make D.C. motors in small ratings.

— **Seven companies** make fractional horsepower A.C. motors. One of these, **British General Electric Pty. Ltd.**, is an important manufacturer of other electrical equipment, including large power-distribution transformers and a wide range of electrical appliances. This company is a subsidiary of the General Electric Co. Ltd., U.K. Another, **Tyree Electrical Co. Pty. Ltd.**, also makes high-capacity transformers and rectifiers.

Transformers

There are three manufacturers of power and distribution transformers in capacities exceeding 10,000 kVA. **Australian General Electric Pty. Ltd.** (see also "Motors") makes power and distribution transformers up to 22,500 kVA, 66,000 volts. — **British General Electric Pty. Ltd.** (see also "Motors") makes power and distribution transformers up to 20,000 kVA, 33,000 volts. — **Crompton Parkinson Ltd.** (see also "Motors") makes power and distribution transformers up to 15,000 kVA, 66,000 volts. — In addition, there are six other companies which make transformers up to maximum capacities varying from about 100 kVA up to 5,000 kVA. **Wilson Electric Transformers Pty. Ltd.** makes power and distribution transformers up to 5,000 kVA, and also makes welding and instrument transformers. — **The English Electric Co. Ltd.** (see "Alternators and Generators") makes power and distribution transformers up to 1,000 kVA. — **Tyree Electrical Co. Pty. Ltd.** (see also "Motors") makes transformers up to 750 kVA. — **Standard Waygood Ltd.** (see "Alternators and Generators") makes transformers up to 500 kVA. — **Hulme Engineering Manufacturing Co.** makes transformers up to 300 kVA, and also makes A.C. motors. — **Essantee Switchgear Pty. Ltd.** makes transformers up to 132 kVA, and also makes switchgear. — In addition to the above, there are nine companies which make transformers up to 50 kVA, and three others making in capacities up to 25 kVA; most of these companies are either mainly engaged in making various types of small transformers, or are small to medium-sized radio and/or electrical-appliance manufacturers. — About six companies, most of them switchgear manufacturers, make potential and current transformers. — Four companies (three also making other types of small transformers) make neon and lighting transformers. — About 12 firms (four also making other types of small transformers) make radio and communication transformers.

Rectifiers

Two companies make mercury-arc rectifiers. **Tyree Electrical Co. Pty. Ltd.** (see "Motors") makes large rectifiers up to 600 amps. — **Don Electrical Co. Pty. Ltd.** makes mercury-arc rectifiers, and also makes small transformers, welding equipment and testing and measuring equipment. — Four other companies make selenium rectifiers. **Standard Telephones and Cables Pty. Ltd.**, a large manufacturer of radio transmitting and receiving apparatus, electrical appliances, telephone apparatus, etc., makes selenium rectifiers up to 1,000 amp. capacity. — **McKenzie and Holland (Aust.) Pty. Ltd.** makes selenium oil-immersed metal rectifiers up to 4,000 amp. capacity, and also makes industrial switchgear. — **Australian General Electric Pty. Ltd.** (see "Motors") and **Gladstone Electric Co. Ltd.** are the other two manufacturers of selenium rectifiers.

Switchgear

There are four manufacturers of high-voltage, high-rupturing-capacity switchgear: **Australian General Electric Pty. Ltd.** (see "Motors"); **Standard Waygood Ltd.** (see "Alternators and Generators"); **Westinghouse Rosebery Pty. Ltd.**, which also makes potential and current transformers, and is a subsidiary company in a large group of companies making a wide range of electrical and other products including refrigerators, washing machines, pumps, air cleaning equipment, petrol/kerosene engines, etc.; and **Stanger and Co. Ltd.**, which also makes fuses and cable fittings.

Low-voltage heavy-current switchgear is made by four companies: **Westinghouse Rosebery Pty. Ltd.** (see above); **B. & S. Electrical Co. Pty. Ltd.**, making only switchgear; **Johnson and Philips (Aust.) Pty. Ltd.**, which also makes starters and controllers, particularly heavy-duty type, and is a subsidiary of a U.K. company; and **O. J. Nilsen Ltd.**, which, together with its subsidiary companies, also makes small transformers and starters and controllers, a range of electrical appliances, fuses and ironclad switch and fuse gear, operates a radio-broadcasting station, and is a major manufacturer of porcelain for electrical purposes.

Starters and Controllers

There are about 20 companies making starters and controllers, open and metal-clad, for industrial purposes. Two of these also make switchgear (see above). About half of the remainder make starters and controllers as a major activity, the rest combine this manufacture with a range of other electrical equipment.

Meters (Watt-Hour)

Two companies make all electricity meters required in Australia for domestic and industrial uses, except for a few special types. **Electricity Meter Manufacturing Co. Pty. Ltd.**, Sydney, N.S.W., is a subsidiary in a group of companies making a wide range of electrical equipment

and appliances, including refrigerators; washing machines; food mixers; radio receivers; telephone equipment; plastics products; electrical ceramics; kerosene-fuel heaters; gas stoves, ovens and meters; water meters; irrigation and spraying equipment; sheep-shearing machines; grain silos; electric-light plants; etc. — The other manufacturer, **Warburton Franki Ltd.**, Sydney, N.S.W., also makes transformers, time switches, industrial exhaust fans, electric door-chimes, etc., and is a large merchanting company for a wide range of electrical products.

Furnaces and Induction-Heating Equipment

There are about 11 manufacturers of this equipment in Australia. Two companies which specialise in furnace manufacture make a range of electric furnaces; one also makes gas-fired and oil-fired furnaces. The other nine companies make a limited range of types; at least three of these also make oil and gas furnaces. Manufacture of electric furnaces is often combined with that of industrial ovens for core baking, paint drying, etc. (see also Chapter 12).

Electric-Welding Equipment

There are about 12 companies which make electric-welding equipment. (Five of these also make electrodes.) Three companies make only welding equipment; the rest also make various other products. Two companies, **E.M.F. Electric Co. Pty. Ltd.**, with two establishments, and **Quasi-Arc Pty. Ltd.**, are subsidiaries of Commonwealth Industrial Gases Ltd. (see Chapter 6); the former is also the principal Australian manufacturer of welding electrodes. — **Lincoln Electric Co. (Aust.) Pty. Ltd.**, an associate of a U.S.A. company, makes a range of welding machines and accessories and electrodes, and also makes electric motors. — **G. G. Martin Ltd.** also makes alternators and generators, and electric motors. — **Don Electrical Co. Pty. Ltd.** also makes transformers. — One other company also makes starters and controllers. — Two others make only welding equipment. — Of the remainder, one also assembles storage batteries; one also makes etching and engraving machines, rivet heaters, oil-filter presses; one also makes battery chargers and testers, rectifiers, etc.; one also makes pyrometers, salt-bath furnaces.

Welding Electrodes

There are three principal manufacturers of welding electrodes: **E.M.F. Electric Co. Pty. Ltd.**, with two establishments (a subsidiary of Commonwealth Industrial Gases Ltd.—see Chapter 6); **Lincoln Electric Co. (Aust.) Pty. Ltd.**, both of which also make electric-welding machines; and **Murex (A'asia) Pty. Ltd.**, Derwent Park, Tas., which is a subsidiary of a U.K. company.

Batteries

PRIMARY DRY-CELL BATTERIES are made by four manufacturers. One company is part of an overseas battery-making company of similar name. — One company is a subsidiary of a large radio-manufacturing organisation (which, indirectly, is the only manufacturer of acetylene black in Australia).

LEAD-ACID STORAGE-TYPE BATTERIES are completely made by six companies. These groups make practically all the component parts and supply the trade as well as producing their own requirements. Manufacture of batteries in each case is a major activity. Ten companies manufacture some components and assemble complete batteries, in the majority of cases, as a major activity. Numerous other firms assemble batteries.

(There are only six Australian manufacturers of battery containers. One of the largest, **Dunlop Rubber (Australia) Ltd.**, is also the largest rubber-products manufacturer in Australia; this company, as well as making a complete battery for sale under its own brand, supplies containers to other battery makers. Most of the other five make containers only for their own use.)

Fittings

PLUGS, SWITCHES, SOCKETS, etc., are made by five manufacturers who make almost a complete range of all types of fittings. — Several smaller firms make a limited range. Three of the major firms combine manufacture with production of conduit and/or other fittings. (See Chapter 9 for comment on **CONDUIT** and fittings. There are six manufacturers, one with two establishments; all the conduit makers also make conduit fittings.)

CONDUIT FITTINGS: Principal manufacturers are the conduit makers—see previous listing. Other manufacturers, seven in number, of conduit fittings are so engaged as an incidental part of electrical-products manufacture; five making switches, plugs, etc., including the largest makers of such in Australia; one makes flexible tubing, switchgear, screws, rivets, etc.; one is a major manufacturer of a wide range of electrical products.

Electro-mechanical Testing, Measuring and Indicating Instruments (meters—voltmeters, ammeters, wattmeters, etc.; bridges—"Wheatstone", "Kelvin", "Mueller"; standard cells, galvanometers; potentiometers; resistance boxes, resistance standards): One company makes a wide range of types conforming to standard and sub-standard accuracies. One company, closely associated with the above company, also makes some instruments to standard accuracy but is chiefly engaged in making for commercial use. One company makes a limited range of items conforming to standard, sub-standard and first-grade accuracy. Six other companies make individual items chiefly to first-grade accuracy.

APPLIANCES: There are no official statistics relating to the number of manufacturers of electric appliances. A substantial quantity of appliances is made, collectively, by manufacturers chiefly engaged in the manufacture of electric apparatus. Electric stoves, ovens and ranges are mainly made by specialist manufacturers of stoves, ovens and ranges, although there is an increasing tendency for these items to be manufactured with electric stovettes and grillers in purely

electrical-appliance establishments. About 50 per cent. of refrigerator output, both commercial and domestic types, 80 per cent. of washing machines and fans, and 60 per cent. of the vacuum cleaners are made outside the electric-appliance industry. The majority of these manufacturers are included in the engineering and sheetmetal-working industries (see below).

Electro-Mechanical Appliances

AIR CIRCULATORS AND FANS: Nine manufacturers of air circulators and fans and another two manufacturers of fans, table or desk type, up to 16 inches.

MIXERS—FOOD, DRINK, etc.: Five manufacturers of drink mixers, two of which also make food mixers. — Five other manufacturers of food mixers.

FLOOR POLISHERS, VACUUM CLEANERS, LAWNMOWERS: Seven manufacturers of floor polishers, all of whom manufacture vacuum cleaners. — Four other manufacturers of vacuum cleaners (one company not making any other electrical appliances). — Two manufacturers of rotary lawnmowers, both of whom make floor polishers and vacuum cleaners.

REFRIGERATORS: Nine companies can be regarded as manufacturers of domestic open and/or sealed type electric domestic refrigerators in that they actually make the refrigeration unit. Two of the manufacturers are leading motor-vehicle manufacturing companies associated with U.S.A. companies. Some others make refrigerators of overseas pattern on licence. — Several other firms only assemble. — Eight manufacturers, including three from the above group, manufacture electric-element absorption-type refrigerators. (See also "Refrigeration Equipment", Chapter 12.)

WASHING MACHINES, SPIN DRYERS, etc.: Twelve companies make washing machines of various types, mainly agitators with powered wringer. — One company makes a washing machine of the electro-sonic type, operating on sound vibrations, and another company makes a semi-automatic machine (these two companies, together with two other companies, do not manufacture any other electric appliance). — Of the remaining eight companies, two are large sheetmetal-working establishments and both make electric cooking stoves; the other six make a range of electric appliances.

Cooking Equipment

STOVES, OVENS, RANGES, STOVETTES, TOASTERS, GRILLERS, WAFFLE-IRONS, PIE WARMERS, FOOD TROLLEYS, FISH FRYERS, BAIN MARIES, PERCOLATORS, IMMERSION HEATERS, JUGS, KETTLES AND TEAPOTS: Made by at least twenty companies that make domestic and/or commercial units. A few companies make almost the entire range, others specialise in production of particular units.

Heating Equipment

BED WARMERS, CLOTHES DRYERS, DRYING CABINETS, FOOT WARMERS, IRONS, IRONERS, HEATER PADS, RADIATORS, SPACE HEATERS, ELECTRIC FIRES, etc.: Made by numerous firms, including small to medium-size, either manufacturing or assembling. Some inter-relation of activity exists between this group and the cooking-equipment group.

HOT-WATER SERVICES, BATH-HEATERS, SINK-HEATERS and WASH BOILERS: Made by about thirty manufacturers, of which a few specialise in this field. At least twenty firms also make appliances included in either of the above groups, the remainder are included in other than the electric-appliance field.

LAMPS (INCLUDING FLUORESCENT AND NEON-TUBES)

Filament and Hot-cathode

FILAMENT LAMPS are made by three manufacturers. The major manufacturer produces at least 90 per cent. of all electric filament incandescent lamps made in Australia. The company is an association of several of the leading manufacturers of electric lamps in the U.K. and the Continent, and the company's products are sold under the brand names of those manufacturers. The company is the only manufacturer of **HOT-CATHODE (fluorescent) TUBES** in Australia; the tubes are also sold under the various brand names. (The glassware for the company is made by a subsidiary company owned by the lamp-manufacturing company and the principal manufacturers of thermionic tubes in Australia; the glassworks is adjacent to the lamp factory.) — One of the three manufacturers of filament lamps is a company in which an electrical-products warehouse and a U.K. manufacturer of electric lamps are associated (importing the glassware) and using the brand of the U.K. manufacturer. — The other of the three manufacturers of filament lamps is a company within a large associated group of companies of which the leading glass-products manufacturing companies in Australia are a part; one of the glass-products companies supplies the glassware components. (Automotive lamps are covered in this study in "Motor Accessories", Chapter 10. Torch lamps are not made in Australia.)

Cold-cathode

COLD-CATHODE TUBES for advertising signs and for lighting are made by about twelve manufacturers, all of which purchase the glass tubing (which is made in Australia). At least eight of the companies make both lighting tubes and advertising signs; the remainder make only advertising signs.

COMMUNICATIONS-ENGINEERING INDUSTRY (INCLUDING ELECTRONICS ENGINEERING)

In 1949-50 there were 129 establishments and in 1948-49 136 establishments wholly or mainly engaged in the manufacture of wireless and amplifying apparatus. Of the 136 establishments in 1948-49 77 each employed up to 10 persons, 15 each from 11 to 20 persons, 23 each from 21 to 50 persons, 4 each from 51 to 100 persons, and 17 each more than 100 persons. The latter 17 establishments employed 7,806 persons out of an industry total of 9,411 persons; the more-than-50 group employed 8,088 persons, and the not-more-than-50 group 1,323 persons. In 1948-49 about 12 per cent. (by number) of the quantity of domestic radio receivers and about 4 per cent. (by value) of other wireless and amplifying apparatus were made or assembled elsewhere than in the radio industry, probably mainly in certain establishments principally concerned with manufacture of electrical products. In the same period the radio and electronics industry made 20 per cent. (by value) of the total Australian output of transformers and converters below 20 kVA; about 15 per cent. (by value) of the output of telegraph and telephone apparatus; nearly half (by value) of output of intercommunication systems; and a portion (extent not disclosed) of the output of regulating, starting and controlling apparatus.

For convenience of arrangement of activities, the manufacture of telephone and telegraph apparatus, and of recording apparatus, is grouped with radio and electronic apparatus to make one group of communications-engineering activities in this study. (In official statistics, however, "Wireless Apparatus" comprises a sub-class of its own, and the other two activities are included in the sub-class "Electrical Machinery and Equipment".)

RADIO AND ELECTRONIC APPARATUS OTHERWISE

Wireless Communication Equipment

HIGH-FREQUENCY and VERY-HIGH-FREQUENCY TRANSMITTING AND RECEIVING APPARATUS: Made mainly by three large radio and telecommunication manufacturing companies which make a wide range of all types of high-frequency and very-high-frequency equipment, including airport-control equipment, air-navigation and direction-finding equipment, distance-measuring equipment, mobile transmitting and receiving apparatus, and point-to-point radio equipment. These three companies are also the largest manufacturers of domestic radio receivers. One company also makes a range of telephone and telegraph apparatus. Three other firms are manufacturing h.f. and v.h.f. equipment in limited quantities.

RADIO RECEIVING AND TRANSMITTING EQUIPMENT, including domestic radio receivers: Three major firms are pre-eminent in the telecommunications industry and the manufacture of domestic radio receivers. Eight other large firms make radio in conjunction with other communication equipment; of these eight companies, three also make a range of other telecommunication equipment, one also manufactures machine tools and accessories, bicycles and batteries, and the remainder make domestic radios as a major activity. Numerous small to medium-size firms make or assemble domestic radio receivers. One company, making thermionic tubes used by radio manufacturers in Australia, also makes a wide range of electrical appliances.

Radio Components

THERMIONIC TUBES: Made by three companies. One company, a subsidiary of one of the three largest radio-manufacturing companies, makes a wide range of transmitting and receiving tubes. — One company, which is one of the three major radio companies, makes special types of tubes. — One other company makes radio receiving tubes.

CHOKES are made by about eight manufacturers apart from the major radio manufacturing establishments which make their own requirements. These eight firms also make transformers.

CONDENSERS are made by four major manufacturers, including a large radio-manufacturing establishment, with one other producer predominantly important.

SPEAKERS are made by three major manufacturers, principally by one company, which also makes winding wires; and by two radio-manufacturing establishments.

COILS are made by all major radio manufacturers who make their own coils. Two other firms also make coils.

CARBON RESISTORS are made by three major manufacturers, two of which specialise and the other also makes condensers.

WIRE-WOUND RESISTORS are made by several small manufacturers.

Electronic Equipment

PROCESS CONTROLLERS, LEVEL INDICATORS for liquids, **PHOTO-ELECTRIC RELAYS,** and **COUNTERS** (all types): Made by one large manufacturer of electrical machinery and apparatus making a limited range of items. Several smaller companies make a limited range of items for commercial usage.

HIGH-FREQUENCY (DI-ELECTRIC) HEATING UNITS are made by two manufacturers, both of which are major manufacturers of communications equipment.

Electronic Testing, Measuring and Indicating Instruments (monitoring equipment—noise meters, amplitude modulation monitors, frequency modulation monitors; meters—audio frequency, output, vacuum tube volt-meters; signal generators, oscillographs, wavemeters, valve testers): One

large manufacturer of radio and telecommunications equipment makes a range of high-quality testing and measuring instruments to standard accuracy. Five other manufacturers make a limited range, chiefly for commercial usage.

TELEPHONE AND TELEGRAPH APPARATUS: Telephone and telegraph apparatus is made by about fifteen manufacturers, three of which make items in this field as a major activity; the remainder are chiefly engaged in the manufacture of radio receiving and broadcasting equipment. The Postmaster-General's Department also makes a considerable amount of its requirements in its own communication engineering workshops. Four firms manufacture telephone inter-communication systems. Activities are as follows—

One company, an associate of a U.K. company, makes a range of communication-engineering equipment, including carrier telephone, automatic switching and telephone train-control equipment; handset telephones; public-address and intercommunication systems. This company is also associated with the manufacture of telephone cables, and is a manufacturer of radio broadcasting and transmitting equipment, domestic radio receivers, thermionic tubes, selenium rectifiers, electronic-heating equipment, and a range of electric appliances.

One company, which is an association of four British companies and one American company, is solely engaged in the manufacture of telephone-exchange automatic equipment.

One company makes a wide range of carrier telephone equipment and component parts, including transformers. **One company,** the largest manufacturer of radio and telecommunications equipment in Australia, makes handset telephones, automatic-telephone apparatus, and has made carrier-telephone equipment to special order, manual trunk-telephone switchboards, and relays for switching purposes.

One small firm makes telephone intercommunication systems.

One company, the largest manufacturer of domestic radio receivers, makes small switchboard components and intercommunication systems, and also makes high-frequency and very-high-frequency radio transmitting and receiving apparatus.

One company, the major activity of which is the manufacture of intercommunication and public-address systems, also makes buzzers, junction boxes, and magneto telephones for field and mine use.

One company, a major manufacturer of domestic radio receivers, makes relays and relay sets.

One company makes a wide range of component parts, including terminal and lamp strips, jacks and jack strips, fuse mountings, telephone plugs and keys, voice-frequency dialling and signalling apparatus, and distribution boxes.

The Postmaster-General's Department in its own workshops makes a wide range of equipment, including handset telephones and components, bells, hand generators, telephone and telegraph switchboards, indicators, jacks and jack strips, relays, terminal equipment, public-telephone instruments and cabinets, lifting tools, motor bodies, radio transmitters, and equipment, aerial arrays, radio receivers, measuring and testing equipment, manhole covers and frames, aerial line equipment, protective equipment and numerous other items.

RECORDING APPARATUS

SOUND-RECORDING APPARATUS and PLAYBACK UNITS: Three principal manufacturers. **One company** makes a complete range of sound-recording and reproduction equipment. — **One company** makes small playback units for domestic use. — **One manufacturer** makes turntables, traversing gears and recording blanks. — **A number of firms** will make items of recording equipment to specific orders.

TAPE RECORDERS, WIRE RECORDERS: Five manufacturers. **One company** makes a tape recorder and a wire recorder, and is also engaged in the manufacture of sound-film projectors, spark-plugs and diesel injection equipment. — **One company** makes a tape recorder and is also the major manufacturer of sound-recording equipment. — **One company** which also makes film projection equipment makes tape recorders. — **One company** which makes tape recorders also makes transformers and is preparing to make wire recorders. — **One company** mainly engaged in making microphones, amplifiers and transformers makes tape recorders. — **A further company,** associated with a manufacturer of electrical equipment, will be producing tape recorders in the near future.

Part Two: Outline of Capacity of Manufacturing Activities

THE following notes deal with the various sections of the electrical-engineering industry before proceeding to discuss the communications-engineering industry. Value of output of factories wholly or mainly engaged in these industries totalled over £54 million in 1949-50, and would now exceed £70 million a year.

THE ELECTRICAL-ENGINEERING INDUSTRY

The electrical-engineering industry in Australia was well established before the 1939-45 War, and most types of equipment now available were in production prior to 1939. Value of output in 1949-50 of factories wholly or mainly engaged in electrical engineering, and manufacture of wires and cables, appliances, etc., was more than £42 million, and would now be nearly £60 million a year.

The manufacture of electrical equipment in Australia has always met severe competition from overseas, and this fact has probably ensured that most manufacturers are up-to-date in the type of product manufactured and competitive in the cost of production.

Several organisations produce equipment under licence from overseas manufacturers, and this, together with the establishment of branch factories of overseas companies, has added large research facilities and appreciable technical knowledge and experience to the Australian industry.

The manufacture of electrical equipment in Australia covers a wide range and includes such items as generators, motors, transformers, switchgear, industrial and other heavy electrical-control equipment; lighting components, including lamps, bulbs, tubes, etc.; domestic and other appliances; cables and wires, both insu-

lated and bare, for all applications, including the winding of coils, the wiring of switchboards and electric power-supply reticulation systems.

It can be said, generally, that the Australian electrical industry is equipped to produce a large part of Australia's requirements. The manufacture of motors over 125 h.p. and large power-generating equipment is not carried out to any appreciable extent. As there is a very great demand for electric power in Australia, and with the projected electric power-supply schemes over the next ten years, the expansion of manufacture in this field becomes a matter of importance. Most of the heavy electrical equipment used in Australia has been imported from either Great Britain or the Continent. The present-day commitments, which those suppliers have to meet, must seriously affect the availability to Australia of sufficient supplies from those sources. Although manufacture of certain equipment in this field may have been regarded by some industrialists as uneconomical in Australia, the urgency of the need for it and the difficulty of obtaining sufficient supplies in reasonable time from overseas sources may warrant further assessment of the practicability of extending present manufacturing activities in Australia.

WIRES AND CABLES

The manufacture of power and communication wires and cables is well established in Australia, and the industry's capacity appears to have been kept close to normal demand for all types of wire and cables other than lead-covered paper-insulated cables and some special types such as resistance wires of the nickel-chrome type.

Expansion by established manufacturers is continuing. In addition, the manufacture of lead-covered and aluminium-covered paper-insulated power-mains cables—the most significant of the "gaps" in types produced in Australia—will begin in 1952 at a factory being established for that type of cable by a new company. Another new company is to establish a factory which is expected to begin production by 1955 of power-mains cables, stranded bare conductors, and winding wires. The production of aluminium steel-cored cable is to be doubled in the next 18 months.

Capacity to draw heavy copper conductor wire is also being expanded.

Details of types and quantities of power and communication wires and cables produced in Australia are not collected by the Commonwealth Statistician. Full use of established capacity has not been possible over the past two years because of shortages of copper; and, in addition, the demand for some types of wires and cables has been abnormal because of the rapid rate of expansion of supply of electric power, communications, factory and house construction, etc. Those factors have caused a substantial increase in imports. Demand for wire, particularly for reticulation, has declined in 1952 mainly because of re-phasing of reticulation programmes. Exports are strictly controlled and have virtually ceased, except for small quantities to New Zealand and the Pacific Islands. Consideration is being given to permit exports to these areas on a quota basis.

Imports in 1948-49 and 1949-50 were—

IMPORTS:

	1948-49	1949-50
Wire (except Brazing and Soldering Wire and Covered Electric Wire)—		
Copper	cwt. 42,927	cwt. 100,294
Other copper-base alloy	1,448	23,857
Non-ferrous and non-ferrous alloy wire, single strand, n.e.i., for electrical purposes (not covered)	2,989	910
Other non-ferrous and non-ferrous alloy single strand wire, n.e.i.	3,212	24,923
Wire and cable, stranded or twisted—copper	18,818	59,020
Electric Light and Power Cable and Wire, Covered—		
Lead-covered and lead-covered and armoured—		
Paper-insulated	91,780	97,146
Otherwise insulated	25,728	25,841
Other than lead-covered—		
Covered with cotton only, whether or not impregnated	505	484
Covered electric light and power cable and wire, n.e.i.	39,249	57,919
Telegraph and Telephone Cable and Wire, Covered—		
Lead-covered and lead-covered and armoured—		
Paper-insulated	78,848	187,794
Otherwise insulated	13,487	6,564
Other than lead-covered—		
Covered with cotton only, whether or not impregnated	59	689
Covered telegraph and telephone cable and wire, n.e.i.	11,155	16,932
Other Covered Electrical Cable and Wire and Copper Strip, Covered, Electrical—		
Enamelled Wire—		
Not otherwise covered	11,361	10,895
Covered only with cotton, whether or not impregnated	3,042	4,747
Covered with other material, n.e.i.	4,428	3,623
Wire, Plain, Tinned and n.e.i., also Copper Strip (Plain and Tinned)—		
Covered only with cotton, whether or not impregnated	1,424	1,198
Covered with other material, n.e.i.	15,758	20,274

ELECTRICAL MACHINES AND APPARATUS

Alternators and Generators

Australian production of generators is confined to capacities below 100 kW. Only one alternator of high capacity (about 20,000 kW) has been made in Australia; however, the major components were imported for local machining and assembly. Total Australian output of alternators in 1949-50 was 273, valued at £75,110; and of generators, 9,461, valued at £518,322.

Australia's imports of alternators and generators in 1949-50 were as follows—

IMPORTS:	1949-50	
	no.	£
Alternating current generator-set units (alternator-set units)	233	61,591
Direct-current generator-set units (generator-set units)	1,453	274,652
Alternators, other, including exciters—		
Alternators for use with steam or water driven turbines	87	718,579
Other alternators, n.e.i.	1,231	590,118
Direct-current generators, other—		
Generators for use with steam or water driven turbines	40	4,107
Other generators, n.e.i.	2,034	176,067
Current-generating machines, n.e.i.	800	9,408

The principal sources of Australia's imports of alternators and generators were the United Kingdom, the United States of America, Switzerland, Sweden and Germany.

The known demand for this equipment over the next ten years is significant, being of the order of 94 units with ratings varying from 750 to 50,000 kW for an additional installed capacity of about 3,800,000 kW.

Electric Motors

Alternating-current electric motors are manufactured in Australia in a wide range of ratings including fractional horsepower. Direct-current motors are also manufactured to meet limited requirements for traction and other special purposes. Some manufacturers include in their range drip-proof, flame-proof, and other special types. There are numerous firms engaged in the manufacture of electric motors

either for supply to the trade or for use in their own electrical appliances. A.C. motors are manufactured in both single-phase and three-phase types, with ratings in the latter up to 500 h.p. Although A.C. motors up to 500 h.p. have been manufactured to special order, the majority of local requirements for sizes over 200 h.p. are met from overseas sources. D.C. motors are manufactured in ratings up to about 150 h.p. and local supplies are generally sufficient to meet requirements.

Australian production of electric motors for 1949-50 was as follows—

PRODUCTION:	1949-50	
	no.	£
Made or incorporated in own products—		
Under 1 h.p.	213,365	(a)
1 h.p. and over	28,888	(a)
For sale—		
Under 1 h.p.	105,744	970,180
1 h.p. and under 2½ h.p.	24,422	385,246
2½ h.p. and under 5 h.p.	13,962	321,298
5 h.p. and under 10 h.p.	6,413	289,376
10 h.p. and under 50 h.p.	4,096	284,053
50 h.p. and over	349	103,903

(a) Quantity only available.

More recent, but less detailed, production figures were as follows—

PRODUCTION:	1950-51	1951-52
	no.	no.
Under 1 h.p.	447,881	306,257
1 h.p. and under 2½ h.p.	29,491	14,917
2½ h.p. and under 5 h.p.	14,773	8,529
5 h.p. and under 10 h.p.	8,977	4,887
10 h.p. and over	4,301	3,903

(a) First seven months.

Despite the rapid growth in the manufacture of electric motors over recent years, imports over the past few years have been particularly heavy. In 1948-49, a total of 267,500 units were imported, valued at £2,703,830, which was practically double the imports for 1947-48. In 1949-50 imports were lower, and comprised 153,511 units, valued at £2,552,819. Details of the 1949-50 imports were as follows—

IMPORTS:	1949-50	
	no.	£
Under 1 h.p. (except as part of machines)	120,448	728,719
Alternating current—		
1 h.p. and over (induction)	27,099	1,263,249
Other (including commutator type)	2,261	178,948
Direct current—		
For use with gearless lifts	388	12,456
Traction motors (parts of electric trolley buses)	121	77,532
Traction motors, other	342	98,379
Direct current motors, n.e.i. . . .	2,503	180,233
Universal current	349	13,303
Totals	153,511	2,552,819

Since March, 1952, all imports are subject to licence—see Appendix II.

Much of the increased demand has been for electrical-appliance manufactures for fractional-horsepower motors, and from industry generally.

Except for the manufacture of motors over 100 h.p., electric-motor manufacturers in Australia appear to possess the capacity to satisfy local requirements. Chief difficulties which have to be overcome are the shortages of materials and trained labour. The possibility of manufacturing motors over 100 h.p. warrants further consideration.

Transformers

The manufacture of transformers in Australia does not as a general rule exceed units above 22,500 kVA capacity, and production is mainly of units below 15,000 kVA. Production statistics according to capacity are not available; however, 2,560 transformers above 20 kVA were manufactured in 1949-50, at a total value of £626,081. Of these, 2,285 were for use in supplying industrial power and light, and 275 were for other industrial purposes.

In Australia at the present time, there is manufacturing capacity to produce power and distribution transformers amounting to about 650,000 kVA a year. Owing mainly to shortages of steel and insulators, present annual output amounts to about 400,000 kVA. In consequence, Australian manufacturers have been unable to supply local requirements even in the capacities produced, and deliveries in some cases are quoted at upwards of three years. The bulk of transformer imports are of capacities above 15,000 kVA, the chief source of supply being the United Kingdom.

Transformers below 20 kVA, including those for use in neon signs, radio receivers, etc., are manufactured in Australia by many firms. Total production of transformers below 20 kVA in 1949-50 was 226,984 units, valued at £641,485. Types produced were—

PRODUCTION:	1949-50	
	no.	£
For use in neon signs	18,280	63,577
For use in radio and electrical toys	146,949	164,733
For use in supplying industrial power and light	30,205	304,895
For other industrial use	31,550	108,280

A substantial part of total production, 76,952 transformers valued at £124,437, was produced in factories other than those engaged principally in the manufacture of electrical machinery and equipment. The Australian industry appears to possess ample capacity to meet the demand for these types of transformers.

Rectifiers

Value of electric-current rectifiers and rectifier assemblies, including static-type battery chargers, and transformers and control equip-

ment with, or for use therewith, imported in 1947-48 was £82,607, £100,267 for 1948-49, and £179,135 for 1949-50. Exports are considered to be negligible.

One of the main uses of selenium and mercury-arc rectifier units is for the relatively heavy charging rates associated with secondary batteries used for telephone exchanges, electricity supply sub-stations, fork-lift trucks, mine locomotives, etc. Mercury-arc rectifier units are also used in the provision of high-tension requirements for radio-transmitting stations and similar applications.

The bulk of the selenium rectifier manufacture is carried out by two Australian firms, one of which makes rectifier element discs, while the other firm imports its requirements from the United Kingdom. However, this latter firm intends shortly to produce selenium discs. It is understood that supplies of Australian-made selenium rectifier units are adequate to meet current demand and that mercury-arc rectifier tubes are available from the United Kingdom for incorporation in Australian-made equipment. Copper-oxide rectifiers are used in the smaller sizes for telecommunication purposes, and in this respect adequate supplies are available from the United Kingdom.

Converters

Imports of converters, motor or synchronous rotary types (including frequency changers, dynamotors and rotary converters) were: In 1947-48, 54 valued at £145,522; in 1948-49, 156 valued at £8,574; and in 1949-50, 221 valued at £10,311. Large converters for power supply purposes are obtained from overseas. The use of converters for other purposes is very limited, and in many cases may be made in Australia for a specific application as required.

Switchgear

Australian production of heavy-duty switchgear is generally concentrated in ranges below 15,000 volts and of rated rupturing capacities up to 250,000 kVA. In recent years, however, local manufacturers have produced circuit breakers, a main item in switchgear, in ratings up to 22,000 volts and rated rupturing capacities of 350,000 kVA.

The value of output for 1949-50 for regulating, starting and controlling apparatus was £3,348,635. Probably about 20 per cent. of this value consists of distribution switchgear. Most of the imported high-tension switchgear comes from the United Kingdom. Voltage regulators and reactors, relays and arrestors, are nearly all imported. Thus, while the Australian heavy electrical-engineering industry supplies part of the internal demand for heavy electrical switchgear, the larger part of requirements is imported. In the manufacture of industrial controllers and switchgear, and domestic switches and similar fittings, it would appear that sufficient capacity exists to satisfy local requirements.

Electric Furnaces

Electric furnaces are manufactured in Australia for a wide range of industrial processes. Several major Australian firms with overseas connections produce a range of standard types and can manufacture special installations. Equipment ranges from small heat-treatment furnaces to major installations for the heating and annealing of large forgings, vitreous enamelling, etc. No statistics of production, imports and exports are available.

There is a large potential demand for electric furnaces which can be satisfied by Australian production. However, shortages of materials such as steel and refractories have restricted output to a considerable extent.

Enquiries regarding export have been received from overseas from time to time, but orders for export cannot be fulfilled owing to the strong local demand.

Induction-heating Equipment

Low-frequency and high-frequency induction-heating equipment is made in Australia for such applications as the melting of metals and alloys, and for heat-treatment purposes. At present there is not a large demand for induction-heating equipment, but such a position could change overnight, particularly in view of the importance of this item in the manufacture of defence equipment. No statistics of production, imports and exports are available.

Electric-welding Machines and Electrodes

Official published statistics provide no information regarding exporting, importing, and Australian manufacture of welding units, equipment and electrodes.

The use of arc welding for structural work—buildings, processing plant, shipbuilding, for example—is commonplace in Australia. Resistance welding (spot, seam and butt) is used in mass-production work, notable examples being the manufacture of drums, pipes, tubes, conduit and railway track. Machines used in either of the above categories may be classified into full manual control types and semi-automatic and automatic types.

It may be generally stated that arc-welding techniques, units and equipment have passed through a dynamic stage of development. Scope and methods of applications have extended rapidly, and are continuing to do so, because economies, frequently substantial, in time and material are usually gained without significant loss, if any, of advantage of displaced methods. It is understood that supplies of Australian-made electric-welding machines are adequate to meet requirements.

Welding electrodes may be generally classified as covering electrodes for the two classes of electric welding—resistance welding and arc-welding. Shortage of core-wire appears to be the principal factor limiting the Australian output of arc-welding electrodes at present, and in the foreseeable future. The only manufacturer of welding wire in Australia is reported to be quite unable to meet the demand. Imported wire at higher cost is being used; but import figures of this item are not specifically recorded.

Australian production is estimated by one well-known manufacturer to be about 150 million feet of arc-welding electrodes a year. The range of welding electrodes manufactured includes those for stainless steels, tool tipping, manganese steel and hard surfacing. Capacity is in excess of demand. It is estimated that the sales rates of standard electrodes (mild-steel types) are 15 to 1 on a footage basis and $3\frac{1}{2}$ to 1 on a value basis, as compared with other types of welding electrodes. Sellers report greatly increased demand for electrodes.

Meters (Industrial and Domestic)

These meters are of the kilowatt-hour type used for the measurement of electrical energy

in industrial establishments and domestic premises. With the exception of special types for which the demand would not be sufficiently great to justify local manufacture, requirements are made in Australia. Output of meters, domestic and other, of all types in 1949-50 was 348,399, valued at £1,174,569. (In 1950-51, production of gas and water meters, part of the above group, totalled about 98,000.) Imports and exports are not specifically listed.

Electro-mechanical Testing, Measuring, and Indicating Instruments

The grades of electro-mechanical measuring, testing and indicating instruments made in Australia conform to standard and sub-standard (both chiefly for laboratory use) and first-grade (for switchboards and general commercial use) accuracy. (See also "Electronic Testing, Measuring and Indicating Instruments", later, this Part.) The demand for standard and sub-standard instruments is relatively limited, and only three manufacturers have emerged and persisted in Australia, making these instruments. The manufacture of first-grade instruments for general commercial usage offers more scope for volume production, and most firms make only a limited range in this type. There are no statistics available for production, imports or exports of these types of instruments.

Batteries

The manufacture in Australia of batteries, both primary (dry-cell) and secondary wet-cell (lead-acid) types, is well catered for. There are several manufacturers and/or assemblers of secondary batteries of various types and sizes for use in the automobile, wireless and telecommunications fields, and for general use. Sufficient capacity exists to supply local requirements and provide an exportable surplus. Output of secondary batteries for automotive and radio applications is generally meeting the demand. However, difficulty is being experienced in obtaining secondary batteries of the large open-cell types for telephone exchanges, etc., and substantial imports from the United Kingdom have been necessary. Production of secondary batteries for 1949-50 was as follows—

PRODUCTION:	1949-50	
	no.	£
Wet-cell—		
For automotive, radio use ..	934,132	1,992,658
For power plants	125,142	354,411
Other	54,601	253,238
Totals	1,113,875	2,600,307

Imports for 1949-50 totalled 100,595 batteries of various types, valued at £414,412. In addition, parts of storage batteries to the value of £31,015, and miscellaneous items valued at £29,328 were imported. Exports for the same period were 53,111 batteries valued at £161,914, with battery parts valued at £32,127.

Although there are only four manufacturers of dry-cell batteries, productive capacity is more than sufficient for local requirements. Production statistics are not available, but imports for 1949-50 totalled 1,604,055 valued at £24,382, and parts valued at £29,922.

Electrical Fittings

The production of plugs, switches, fuses and sockets, etc., is well established in Australia,

and generally the industry is in a position to cater for the total Australian demand. Value of output for 1949-50 amounted to £1,636,490. (More than two-thirds of the total output was produced in factories not engaged principally in electrical-apparatus manufacture. A substantial proportion would be made by plastics manufacturers.)

ELECTRICAL APPLIANCES

The manufacture of electrical appliances in Australia covers a wide field and includes the production of all types of domestic, commercial and industrial appliances. These may be classified under three categories, namely, electro-mechanical equipment, electric-cooking equipment and electric-heating equipment. The Australian-made items include—

ELECTRO-MECHANICAL EQUIPMENT: Dish-washing machines, drink mixers, cake and food mixers, fans (desk, wall, ventilating, etc.), floor polishers, lawn mowers, shavers, vacuum cleaners (including carpet sweepers, etc.) and washing machines.

ELECTRIC COOKING EQUIPMENT: Coffee percolators, drink heaters, immersion heaters, jugs, kettles, teapots, ranges (including domestic, commercial and industrial), stovettes, ovens (bakery, etc.), pie warmers, toasters (all types), urns and waffle irons.

ELECTRIC HEATING EQUIPMENT: Bedwarmers, clothes dryers, drying cabinets, foot warmers, heating pads, hot-water systems (including sink and bath heaters, etc.), radiators, irons and ironers.

Most of the smaller products are basically of simple design and relatively easy to manufacture. It was these facts which encouraged the establishment of a large number of small manufacturers in the immediate post-war years.

In general, the manufacture of electro-mechanical appliances and the majority of the heavier type commercial and industrial equipment, has more complex problems of manufacture, and in some cases the work can be included in the class of precision engineering.

For the manufacture of the majority of electrical appliances for all uses, there is, generally, sufficient capacity to satisfy most requirements, and indeed there has been a certain amount of over-expansion in some sections of the domestic-appliance field in relation to the present Australian market, which has contracted markedly in recent months. However, there is still quite some importation from overseas sources.

A substantial proportion of production of electrical appliances is produced in factories other than those engaged principally in production of electrical apparatus and equipment. In particular, the major part of total output of washing machines, stoves and stovettes and refrigerators are produced outside the electrical apparatus industry proper—for example, by sheetmetal-working factories, etc.

LAMPS (INCLUDING FLUORESCENT TUBES AND NEON TUBES)

Australian manufacturers produce practically all of the electric lamps required for the local market. Filament-lamp manufacture is mainly in the hands of one large organisation (also the only maker of hot-cathode fluorescent tubes) which is an association of several overseas companies. The other two manufacturers produce only a very small portion of total

Imports of flush plates, ceiling roses, adaptors, etc., totalled £60,172 in 1949-50.

A full range of conduit and conduit fittings is manufactured in Australia. Present production is meeting current demand. There is ample capacity to manufacture requirements, although full operation of capacity is largely dependent on availability of steel supplies.

The following tables show Australian production, and imports and exports, of electrical appliances for the year 1949-50—

PRODUCTION:	1949-50	
	no.	£
Clocks	—	4,661
Fans	48,338	317,475
Hot-water jugs	185,363	191,864
Irons	178,283	255,201
Radiators	85,216	204,675
Toasters	175,054	244,038
Washing machines	31,638	1,338,519
Vacuum cleaners (domestic) ..	70,604	859,161
Stoves, ovens, ranges—electric—		
Commercial, cooking	396	48,962
Domestic, cooking—		
Stovettes, etc.	61,081	537,381
Stoves	40,591	1,206,910
Domestic, heating	1,872	25,869
Electric Refrigerators (a)—		
Household—compression ..	80,515	6,257,957
absorption	12,576	585,360
Commercial	5,016	1,172,857

(a) In addition, there were 69,250 kerosene and gas absorption refrigerators produced, valued at £3,618,372.

IMPORTS AND EXPORTS:	1949-50	
	Imports £A.F.O.B.	Exports £A.
Stoves, ranges, ovens, grillers, etc.	359,935	—
Radiators, toasters, etc.	57,431	—
Other electric heating and cooking appliances	63,587	—
Irons, electric	37,000	—
Clothes-washing machines, domestic	1,114,092	—
Ironing machines, domestic	42,842	—
Dish-washing machines, domestic	112,652	—
Floor-polishing machines, domestic	101,985	—
Vacuum cleaners, domestic	313,602	—
Personal and massage appliances	256,752	—
Fans, office and domestic	69,418	—
Refrigerating appliances, domestic	1,276,733	—
Hearing appliances	162,645	6,395

Production of most items of electrical appliances increased steadily from 1949-50 until early 1952. For instance, production of refrigerators (all types) totalled 202,100 in 1950-51 and 128,380 in the first seven months of 1951-52. Output of domestic electric stoves was 44,900 in 1950-51, and 25,490 for the first five months of 1951-52. Recently, production has declined by one-third and more for most appliances. Customs clearances for 1950-51 show a substantial increase in the value of these imports above the 1949-50 levels. However, since March, 1952, all imports are subject to licence—see Appendix II.

output. No statistics of Australian production of filament lamps and hot-cathode lamps are available. The value of Australian production in 1949-50 of cold-cathode tubes, made by a number of firms, was £992,580.

Imports of electric lamps of all types, except automobile (see Chapter 10), in 1949-50 were as follows—

IMPORTS:	1949-50	
	no.	£
Filament lamps for lighting and heating, under 20 volt—		
Torch and flashlight	1,362,656	16,244
Other	2,602,082	102,097
Miniature lamps over 20 volt	353,810	8,257
General lighting lamps, 20 volt and over—		
Metal-filament, gas-filled	764,346	70,581
Metal-filament, other	1,561,114	85,913
Other, including carbon-filament incandescent lamps	92,452	10,309
Filament lamps for lighting and heating, not elsewhere included	561,346	53,693

Tubes or bulbs (non-filament), including gaseous-discharge types—		
Fluorescent	75,225	45,704
Sodium-vapour and mercury-vapour (non-fluorescent)	9,900	16,585
Other non-fluorescent tubes and bulbs	—	2,461
Arc lamps, other than for projection purposes, including arc and incandescent combined	—	7,086
Electric lamps, n.e.i.	—	23,290

The principal sources of these imports were the United Kingdom, the Netherlands and the United States of America.

THE COMMUNICATIONS-ENGINEERING INDUSTRY (INCLUDING ELECTRONICS ENGINEERING)

The communication-equipment and electronics-engineering industry in Australia is engaged in the manufacture of radio-broadcast receiving and transmitting equipment; high-frequency, very-high-frequency transmitting and receiving equipment for aircraft and

public-utility services; airport-control and general-communications requirements for the Services, inter-departmental and commercial use; radio components and ancillary items; test equipment, telephone and telegraph apparatus.

RADIO AND ELECTRONIC APPARATUS OTHERWISE

Radio Broadcast Receivers

The development of the Australian radio industry followed the establishment in this country of broadcast-transmitting stations, the first of which was set up in 1923. Initially, receivers and parts were imported, but Australian assembly of imported parts was later undertaken on a limited scale. The industry then developed very rapidly. Output of broadcast radio-receiving sets by 1949-50 had increased to 343,323 units at a value of £6,187,044, not including other allied production valued at about £5.5 million. All types of radio receivers, including radiograms, consoles, portables, car radios, together with transmitting equipment, form the bulk of production.

The number of Wireless Broadcast Listener's Licences on issue at 30/6/51 was 2,109,660.

The largest proportion of manufacture is in the hands of several large firms, some of which have connections with overseas manufacturers. The industry is well organised and efficient, and capable of producing almost all of Australia's peacetime requirements, except for some components, principally certain types of thermionic tubes. There has been a substantial decline in demand for radio receivers in 1952.

Television Equipment

Although television equipment has not been made in Australia on a commercial basis, some of the large firms have carried out considerable research in this field. Detailed specifications have recently been made available regarding the type of television transmitting systems to be installed throughout the Commonwealth. It is believed that the manufacturing firms concerned will be adequately

prepared to supply the major part of Australia's requirements of television receiving apparatus.

High-Frequency and Very-High-Frequency Equipment

High-frequency and very-high-frequency radio receiving and transmitting equipment for aircraft, airport control, mobile units, and point-to-point services, have been made in Australia for some years. In general, there are only three firms which make a wide range of equipment in this field. There are three or four other firms which have at various times made a limited range, and have the technical ability to make a wider range when, and if, they are free from other commitments which form their normal activities.

The increasing need for high-frequency equipment to meet the demands of expanding air services and proposed extensions to telegraph and telephone services, would appear to indicate that there is need for expansion of manufacture of some items included in this field.

Electronic Testing, Measuring and Indicating Instruments

As with the electro-mechanical field (see "Electrical Machines and Apparatus", earlier this Part) electronic testing, measuring and indicating instruments conforming to standard, sub-standard and first-grade accuracies are manufactured in Australia. Only one manufacturer makes instruments to standard accuracy, the others concentrate on manufacturing for general commercial use, which offers greater market volume. There are no statistics available to show Australian production, imports or exports of this type of product.

TELEPHONE AND TELEGRAPH APPARATUS

Over the past ten to fifteen years there has been a considerable increase in the amount of telephone and telegraph equipment made in Australia, including telephone instruments, switchboards, insulators, pole-line hardware, cables, relays, carrier telephone and telegraph equipment, and a wide variety of miscel-

laneous apparatus for communication purposes.

Shortages of materials and labour have seriously affected production, while demand has been growing rapidly—it has been necessary to import increasing quantities of equipment, including items which have previously

been manufactured in Australia. Imports for 1948-49 totalled £3,533,579 and for 1949-50 amounted to £6,139,562, including such items as switchboards and carrier equipment. The position has improved greatly in 1952.

With increasing population and industrial activity, the demand for telephone and telegraph apparatus will continue at a high level. As the Australian firms engaged in manufacture also produce a wide range of other communication and/or electrical equipment,

their ability to produce sufficient quantities of telephone and telegraph equipment may be seriously affected.

Some expansion of manufacture of such items as switchboards and multi-channel carrier systems for telephone, telegraph and programme purposes is desirable. The manufacture of machine telegraph systems incorporating teleprinter and teletype apparatus may warrant consideration.

RECORDING APPARATUS

Sound-recording apparatus such as disc recorders, magnetic-tape and magnetic-wire recorders are primarily used in the broadcast and communication fields for the recording of broadcast programmes, where it is essential to preserve a high degree of fidelity in the subsequent reproduction. This is achieved by means of recording and amplifying apparatus, together with play-back facilities. Sound-recording equipment is also used to keep records of meetings, conferences and for office dictation, etc. It covers a wide field of application in the home, school, business, church, professional and radio fields. It is also used for other important applications such as the recording of speech between the personnel of aircraft and ground-control stations.

At present in Australia, the demand for disc-recording units, both for standard and micro-groove recording, is being met by local pro-

duction and by imports from the United States of America and the United Kingdom. Details of imports are not available as they are classified with other items in official statistics.

Wire-recording units of overseas licensed design are being made in Australia, but it is believed that production is insufficient to cope with demand. They give a considerable improvement on the quality of reproduction obtained from disc-recording units, but in certain cases are not as versatile for the recording of small selected programmes, etc., as the disc-type units.

Magnetic-tape recorders have largely replaced disc recorders. Several well-known companies in Australia are making magnetic-tape recorders and are contemplating the production of suitable tape for these units. However, imports from the United Kingdom are believed to be substantial.

Part Three: Basic Statistics

COMPARATIVE STATISTICS, 1938-39/1949-50

NUMBER OF ESTABLISHMENTS AT 1938-39 AND 1949-50
NUMBER OF EMPLOYEES AT 1938-39, 1949-50, JUNE 1950, SEPTEMBER 1951

Activity (Statistical Sub-classes used by Commonwealth Statistician, 1949-50)	Establishments		Employees			
	1938-39	1949-50	1938-39	1949-50	June 1950 (a)	Sept. 1951 (a)
	no.	no.	no.	no.	no.	no.
Electrical Machinery, Cables and Apparatus (b)	360	811	10,666	30,956	32,708	33,853
Wireless and Amplifying Apparatus (c)	72	129	4,828	9,283	10,322	11,145
Totals (d)	432	940	15,494	40,239	43,030	44,998

STATISTICAL SUMMARY, 1949-50

EMPLOYMENT, MALE AND FEMALE
SALARIES AND WAGES PAID, IN TOTAL AND PER PERSON ENGAGED
VALUE OF PRODUCTION
VALUE OF MATERIALS, POWER, FUEL, REPAIRS, etc. } See Explanations,
VALUE OF OUTPUT } Appendix IV

Activity (Statistical Sub-classes used by Commonwealth Statistician, 1949-50)	Employment			Salaries and Wages Paid		Value of Pro- duction	Value of Materials, Fuel, etc. Used	Value of Output
	Males	Females	Persons	Total	Per Person Engaged			
	no.	no.	no.	£'000	£	£'000	£'000	£'000
Electrical Machinery, Cables and Ap- paratus (b).	24,508	6,448	30,956	13,563	438	21,153	21,603	42,756
Wireless and Amplifying Apparatus (c)	6,011	3,272	9,283	3,745	403	5,252	6,510	11,762
Totals (d)	30,519	9,720	40,239	17,308	841	26,405	28,113	54,518

Explanatory Footnotes to Both Tables

- (a) These employment figures are taken from monthly payroll-tax returns and differ slightly from the other employment figures, which are supplied on annual factory returns.
- (b) Also includes electrical appliances, domestic and industrial; electrical welding equipment and electrodes; electric incandescent and fluorescent lamps; electric meters; electro-mechanical testing, measuring and indicating equipment; telephone and telegraph equipment, including electronic; sound-recording apparatus, including magnetic recorders; batteries and battery repairs. Does not include automotive electrical equipment and accessories; electrical conduit; electrical fittings mainly of plastics.
- (c) Includes electronic tubes and devices, but not for communication (see (a) above). Does not include components and fittings mainly of plastics.
- (d) Consideration and comparison of totals must take into account the effects stated in footnotes explaining the composition of certain sub-classes and figure units.

Chapter 12:

**MACHINERY, PLANT, EQUIPMENT,
APPARATUS, NOT ELSEWHERE
INCLUDED**

Part One: Structure of Established Manufacturing Activities

THIS chapter deals in a general way with machinery, plant, equipment and apparatus, but it does not include all the specific items which are in fact covered by the definitions of those terms. For the most part the chapter is concerned with products which, complete in themselves, require no further manufacturing processes before being put to the use for which they are intended. Furthermore, for the most part the types of products are those wholly or mainly made of metal, but some of the items of equipment dealt with in this chapter may include very little metal—spectacles, for example, an item of personal equipment having glass lenses and frequently a plastics frame.

Most items of plant, equipment and apparatus not being wholly or mainly of metal, but wholly or mainly of other materials—such as treated non-metallic minerals, wood (and its derivatives), straw, cane, cork, paper, paperboard, synthesised plastics, rubber, leather, furred skins, textiles, cordage, felt—are dealt with in the chapters specifically devoted to such materials and the products made from them.

In treating those industries which produce or work metals, it was found convenient, less complicating, to adopt the following arrangement, over four chapters—

Smelting and refining of metals	}	Chapter 9: Metals, Shapes, Pipes, Tubes, Castings, Forgings.
Forming of metals to intermediate shapes (blooms, re-rolling ingots, wire rod, etc.) and finished shapes (plate, sheet, bar, pipe, tube, wire, etc.)		
Casting, including diecasting		
Forging, including hot pressing and blacksmithing ...		
Transport equipment—land, sea, air—and repair		Chapter 10: Transport Equipment.
Electrical and electronic products—generating, reticulating, consuming, communicating—and repair ...		Chapter 11: Electrical and Electronic Products.

It becomes the function of this chapter, therefore, to cover all the principal categories of machinery, plant, equipment and apparatus **not elsewhere included in the study**, a very great variety of products, most of which are made wholly or mainly of metal, but some of which contain little or no metal and which are either properly placed in this chapter or could not be suitably included in another chapter. It must be emphasised, moreover, that “equipment” is not a term limited in application to equipment for manufacturing industry; there are categories of equipment that are applicable to one or more of professional, technical, social, domestic and personal uses.

The listing throughout the chapter does not include all the products within the scope of the chapter, but it is considered to give a reasonable indication of the activities involved.

OFFICIAL STATISTICS OF THE INDUSTRIES AND ACTIVITIES CONCERNED

Official statistics provide information about the relevant industrial activities under a variety of sub-class headings, a few of which cover the production of an extensive and heterogeneous range of products, but most of which cover specific categories of products. One quality is common to all—the products of these industrial groupings are “end-products”: they are complete in themselves and ready for use, either by themselves or combined with or installed in other articles. (The product may be a screw or an internal-combustion engine.) Many makers of these end-products carry out also the earlier stages of manufacture, in particular the production of metal castings; those without such and similar facilities use trade-service facilities. Rolled, drawn and extruded metal shapes, and electrical equipment, instruments of various types and similar specialties are mostly bought. The rise of specialty manufacturing has led to availability of a variety of standard equipment—such as variable drives; these types of equipment are bought as complete units for incorporation into the machines being made or modernised.

It must be remembered, however, that there are manufacturers within the scope of this chapter which do not always (some never or seldom) make a complete end-product (as described above), as their sole or main activity is the supply of finished or partly-finished components to other manufacturers which in turn produce the end-product. These sub-contractors are, however, usually part of the same industry or activity. The detail of sub-contracting within an industry and between associated industries can only be guessed. Sub-contracting is a normal practice

and obviously considerable in extent, particularly among metalworking establishments. Specialised manufacturing activities and services have increased considerably in recent years and this has obviously been encouraged by, and has extended, subcontracting.

There are also engineers and mechanics providing a maintenance service for the non-engineering industries and activities, and frequently, in conjunction, carrying out complete overhaul, rebuilding, of machines and manufacture of various small replacement parts.

The integration, overlapping, of the various "industries" and activities making the products that are the concern of this chapter is extensive to the extent that the relating, for the purposes of this study, of official sub-classes into groups comprising or suggesting an "industry" was abandoned. Within the grouping of the chapter there are various combinations of activities which are commonly described as being "industries"—for example, the "engineering industry", the "sheetmetal-working industry", the "stoves and ovens industry", the "wire-working industry", the "agricultural-implements industry", the "hardware industry", the "jewellery industry", the "sporting-goods industry". Each such description conveys a general idea that is convenient, but when an attempt is made to describe an "industry" in detail it is quickly found that the "industry" so merges, overlaps, into nearby "industries" that it evades coherent and convenient description. The complications vary considerably—the "wire-working industry" can be fairly readily defined as to its composition and boundaries, but the description "engineering industry" as commonly used is an extreme in vagueness.

The "industry" concept cannot be avoided in general discussion. It also occurs in the sub-class groupings of official factory statistics, but each of the sub-classes is made up only of those establishments at which the sole or main activity is within the scope of the sub-class. The end-products made by establishments within the sub-class are also frequently made as a lesser activity in establishments classified in other sub-classes—and there are instances where this "outside" production is collectively substantial. The Commonwealth Statistician provides some details of the extent of "outside" production; this information is utilised in the sections of Part Two of this chapter which deal with sheetmetal working; wire working; agricultural implements; and stoves, ovens and ranges. Generally, however, the greater portion of total production of a specific category of end-products (and all of the production of some single items of products) is from establishments grouped into the sub-class concerned.

The presentation below is one that comprehends in one large group all the manufacturing activity in Australia wholly or mainly concerned in the manufacture of—

end-products of metal or mainly of metal, not being electrical or electronic, or vehicles for land, sea or air transport;

certain equipment and apparatus, not necessarily including metal, and particularly for professional, technical, domestic, social and personal use.

The number of establishments wholly or mainly engaged in an activity included in a sub-class (as recorded in official statistics) and for all sub-classes, for 1948-49 and 1949-50, is set out below. The sub-classes are in the order of employment for 1949-50, so that they can be readily appraised from that perspective. It is necessary to know the activities within each sub-class; this essential information is set out in detail in footnotes to the tables of statistics at the close of this chapter, and brief footnotes are provided below (to the first table) to facilitate appraisal of the three tables set out below.

ESTABLISHMENTS:	1948-49	1949-50
	no.	no.
Plant, Equipment and Machinery, including Machine Tools (a)	1,423	1,498
Galvanised Ironworking, Tinsmithing—Sheetmetal Working, Pressing and Stamping (b)	657	695
Other Engineering (c)	1,358	1,495
Agricultural Machines and Implements (d)	196	208
Wire and Wireworking (including Nails) (e)	195	200
Stoves, Ovens and Ranges (f)	62	65
Arms, Ammunition (excluding Explosives) (g)	8	13
Toys, Games and Sports Requisites (h)	191	186
Electroplating (j)	328	304
Cutlery and Small Handtools	128	136
Jewellery (k)	179	188
Other Metal Works (l)	260	194
Surgical and Other Scientific Instruments and Appliances (m)	142	150
Watches and Clocks (including Repairs)	116	127
Optical Instruments and Appliances (n)	102	110
Gas Fittings and Meters	12	12
Gramophones and Gramophone Records (o)	8	6
Pianos, Piano-players, Organs	41	40
Pencils, Penholders, Chalks, Crayons (p)	17	18
Umbrellas and Walking Sticks	16	17
Sewing Machines (q)	20	20
Other Musical Instruments	15	13
Totals	5,474	5,695

(a) This group obviously does not make all the "plant, equipment and machinery" made in Australia, for it does not include the products (as the prime purpose of activity) which are the subject of the other sub-classes of the table, nor does it include land, sea and air vehicles, electrical and electronic machines, equipment, etc., and plant, equipment, etc., not wholly or mainly of metal. It is the main source, however, with the assistance of "Other Engineering", of plant, equipment and machinery otherwise (including many repetition products of metal, among which are diecastings, screws, bolts and nuts, chain), which comprises much of the machinery, plant and equipment made in Australia.

(b) Includes the "working" of uncoated (that is, "black") steel sheet and strip as well as coated (galvanised, tinned, etc.), and of non-ferrous metal sheet and strip; but does not include coppersmithing where carried on as the sole or main activity.

(c) Jobbing, structural and maintenance engineering, each as the sole or main activity.

- (d) Farm and station (pastoral) implements and machines. Includes plant for milk-products factories. Does not include internal-combustion engines or tractors where manufacture of such products is the principal activity.
- (e) Only three establishments draw steel wire for sale as wire, and only a few establishments draw non-ferrous wire for sale as bare wire (see Chapter 9). Does not include screws, bolts and nuts, chain.
- (f) Does not include furnaces and ovens for industrial processing; these are part of "Plant, Equipment and Machinery". The sub-class is primarily concerned with kitchen and household equipment.
- (g) Includes manufacture of ordnance; and repair of sporting guns and rifles by gunsmiths.
- (h) Of all materials.
- (j) Trade service.
- (k) Includes goldsmithing, silversmithing, imitation jewellery.
- (l) Comprises a few minor activities.
- (m) Does not include optical instruments and appliances where manufacture of such is the sole or main activity.
- (n) Includes lenses of all kinds, and ophthalmic goods (which includes complete spectacles). Does not include cameras, film and slide projectors, and accessories, where manufacture is carried on as the sole or main activity; this activity is included in the sub-class "Photographic Material, including Developing and Printing", and comprises only a small portion of that sub-class.
- (o) Includes electrical-reproducing units.
- (p) Includes fountain-pens.
- (q) No one of these establishments itself makes a sewing-machine head.

The employment-size groups of establishments in 1948-49 for each of the sub-classes of this grouping, and for the whole of the grouping, is set out below—

EMPLOYMENT SIZE:	Up to 10 Persons		11-20 Persons		21-50 Persons		51-100 Persons		Over 100 Persons		Total for Activity	
(a)	Est.	Pers.	Est.	Pers.	Est.	Pers.	Est.	Pers.	Est.	Pers.	Est.	Pers.
Plant, Equipment, Machinery	703	3,522	245	3,660	251	7,826	104	7,414	120	31,983	1,423	54,405
Sheetmetal Working, etc. (b)	366	1,812	108	1,574	106	3,331	32	2,282	47	12,056	659	21,055
Other Engineering	1,095	4,307	144	2,093	67	2,038	31	2,094	21	4,507	1,358	15,039
Agricultural Implements, etc.	113	498	25	361	29	855	13	843	16	7,076	196	9,633
Wire and Wireworking (c) . .	102	508	42	618	31	1,093	12	889	8	2,717	195	5,825
Stoves, Ovens and Ranges . .	24	95	15	220	11	358	2	160	10	3,867	62	4,700
Arms, Ammunition	4	16	—	—	—	—	—	—	4	3,712	8	3,728
Toys, Games and Sports Re-												
quisites	129	555	33	461	16	482	8	563	5	1,308	191	3,369
Electroplating	245	1,066	58	830	21	678	3	214	1	351	328	3,139
Cutlery and Handtools	89	328	17	272	10	270	6	413	6	1,446	128	2,729
Jewellery	137	542	17	256	18	536	4	311	3	534	179	2,179
Other Metal Works	196	723	30	434	24	778	7	501	3	683	260	3,119
Watches and Clocks	101	407	8	111	5	152	—	—	2	514	116	1,184
Surgical, etc., Instruments,												
etc.	98	409	23	333	16	487	5	312	—	—	142	1,541
Optical Instruments and												
Appliances	68	302	14	227	17	528	3	214	—	—	102	1,271
Gas Fittings and Meters . . .	3	23	1	19	4	137	1	62	3	464	12	705
Gramophones and Records . .	5	30	—	—	2	72	—	—	1	505	8	607
Pianos, Players, Organs . . .	26	109	13	185	1	38	—	—	1	210	41	542
Pencils, Pen-holders, Chalks,												
Crayons	9	46	5	79	1	34	2	119	—	—	17	278
Umbrellas and Walking												
Sticks	8	41	3	36	4	97	1	56	—	—	16	230
Sewing Machines	14	82	3	46	2	68	1	51	—	—	20	247
Other Musical Instruments . .	13	68	1	11	1	22	—	—	—	—	15	101
Totals	3,548	15,489	805	11,826	637	19,880	235	16,498	251	71,933	5,476	135,626

(a) See footnotes to previous table.

(b) The sub-class includes two steel mills, one of which is wholly engaged and the other almost wholly engaged in the rolling of steel sheet (the steel feed comes from elsewhere); both mills coat, by galvanising, etc., portion of their output. (See Chapter 9.) Allowing an approximate employment of 3,000 persons for the two steel mills, the sheetmetal-working industry proper employed, in 1948-49, about 18,130 persons.

(c) Includes three establishments which also make steel wire for sale as wire.

Information is available for six sub-classes within this chapter as to the employment-size groups of establishments each employing more than 100 persons. These large-factory employment-size groups were as follows in 1948-49—

EMPLOYMENT SIZE:	101-200 Persons		201-300 Persons		301-500 Persons		Over 500 Persons	
(a)	Est.	Pers.	Est.	Pers.	Est.	Pers.	Est.	Pers.
Plant, Equipment, Machinery; Ferrous Foundries; Other Engineering (b)	83	11,527	29	6,970	21	8,006	17	11,900
Sheetmetal Working, etc. (c)	26	3,510	16	3,926	5	4,620	—	—
Agricultural Implements and Machinery	8	1,140	4	1,215	4	4,721	—	—
Wire and Wire-working (d)	3	345	5	2,372	—	—	—	—
Stoves, Ovens and Ranges	3	383	7	3,484	—	—	—	—

(a) See footnotes to the number of establishments table, preceding the previous table.

(b) Separate information for each of the three sub-classes is not available.

(c) See footnote (b), previous table.

(d) See footnote (c), previous table.

ARRANGEMENT OF CHAPTER

This introduction to the chapter has provided a general explanation, including statistics of the number of establishments engaged, employment-size groups of the establishments, and the employment involved, of the various industries and activities grouped together into the chapter. The remainder of Part One ("structure") and the whole of Part Two ("capacity") are each set out in the following sequence—

Plant for Some Specific Industrial Activities.

Plant of a General Nature.

Equipment Not Elsewhere Included, Particularly for Professional, Technical, Social, Domestic and Personal Use.

Sheetmetal Working, Finishing (Coating, Polishing, etc.), Wire Working, Screws, Bolts and Nuts, Chain of All Types.

Service Activities—Trade Services, Sub-contracting, Jobbing, Maintenance and Repair.

PLANT FOR SOME SPECIFIC INDUSTRIAL ACTIVITIES

In this section there are set out the principal types of plant made in Australia specifically for certain activities, the approximate number of manufacturers, and information about other products or significant association of a manufacturer, where appropriate. The types of plant are—

- Agricultural and Pastoral Plant
- Automotive Service-station Equipment
- Boot and Shoe Plant
- Brick, Tile and Pottery Plant
- Chemical and Pharmaceutical Plant
- Clothing Plant
- Construction Plant
- Food-products Plant, including Food Packaging
- Gas Making and Reticulation Plant, including Gas Meters
- Hotel and Restaurant Kitchen Equipment
- Laundry and Drycleaning Plant (Commercial)
- Metalworking Plant
- Mining Plant, including Mineral-treatment Plant
- Oil-refining Plant
- Office and Shop Equipment
- Ophthalmic and Optical Goods Plant
- Paint and Printing-ink Plant
- Paperworking and Printing Plant
- Plastics-products Plant
- Pulp, Paper and Paperboard Plant
- Rubber-products Plant
- Smelting and Refining Plant
- Soap and Washing-powder Plant
- Tanning and Leather-working Plant
- Textile Plant, including Fibre-processing Plant
- Tobacco-processing Plant
- Woodworking Plant

AGRICULTURAL AND PASTORAL PLANT

Agricultural Implements and Machinery: There are more than 200 establishments classified in official statistics as manufacturers of agricultural implements and machinery. Many of the small companies, however, are more concerned with repair than with manufacture of such equipment. The industry is dominated by a few large companies, which make a wide range of machines and implements. In 1949-50, the seven largest companies in the industry employed nearly 60 per cent. of the total number of persons employed. **H. V. McKay-Massey Harris Pty. Ltd.**, Sunshine, Vic., which is associated with the Massey Harris Co. Ltd., Toronto, Canada, is probably the largest agricultural-machinery manufacturer in the Southern Hemisphere, and makes almost a complete range of agricultural implements. A general description of the type of machines made (in all, more than 300 different implements) includes tillage, seeding and planting, harvesting, hay-making, pasture renovating, orchard and vineyard, and dairy machinery; milking machines, saw benches, petrol engines, potato diggers, grinding mills; in addition tractors, imported in a knocked-down condition, are assembled. — **International Harvester Co. of Australia Pty. Ltd.**, Geelong and Dandenong, Vic., associated with the International Harvester Co., Chicago, U.S.A., makes a wide range of agricultural machinery and equipment, and also makes trucks (see Chapter 10, "Transport Equipment") and wheeled tractors. Agricul-

tural machinery made includes a wide range of tillage, seeding and planting, and harvesting machinery, milking machine and other miscellaneous farm implements. — **Howard Auto Cultivators Ltd.**, Sydney, N. N., specialises in the manufacture of powered rotary-hoes, and also makes petrol and kerosene engines, mainly for use in the company's own products. — **Toowoomba Foundry Pty. Ltd.**, Qld., makes windmills (it is the principal Australian manufacturer), water-boring plant, milking machines, and also makes diesel engines, pumps, generating sets, and air-compressor units. — **Horwood Bagshaw Ltd.**, Adelaide, S.A., makes a range of agricultural equipment including harrows, hay balers, headers, ploughs, rakes, scarifiers, scoops, seeders, seed boxes, chaffcutters, windmills, etc., and also makes elevators, engines, grain and corn grinders, saw benches. — **David Shearer Ltd.**, Adelaide, S.A., makes headers, harvesters, harrows, strippers, plough shares, harrow shares, etc. — **John Shearer & Sons Ltd.**, Adelaide, S.A., makes ploughs, cultivators, seeding implements, harvesters, etc.

In addition to the above seven large companies, there are about ten, of medium size, which make a more limited range of agricultural implements, mainly specialising in a particular type of equipment—e.g., harvesting, or tillage, or seeding and planting, etc. — The large number of small to medium-sized firms in the industry usually only make a limited range of machines of a particular type, mainly the smaller and less complex implements. (Most of the larger manufacturers, and some of the smaller establishments, operate foundries for the production of ferrous and/or non-ferrous castings for their products.)

Agricultural Tractors: See "Tractors", later this Chapter.

Milking Machines: In addition to those companies engaged in the manufacture of agricultural machinery, a number of which make milking machines (see above), there are about five medium to large-sized companies making milking machines. **Moffatt-Virtue Ltd.**, Sydney, N.S.W., makes milking machines and also makes spray-irrigation systems; sheep-shearing machinery; petrol, kerosene and diesel engines; lighting plants, windmills, etc. — **Daniel Scott Pty. Ltd.**, Melbourne, Vic., specialises in making dairying equipment of all types, and also makes stainless-steel food-processing equipment. — **Ronaldson Bros. & Tippett Ltd.**, Ballarat, Vic., makes milking machines and also makes petrol, kerosene and diesel engines (one of Australia's largest manufacturers); spray-irrigation equipment; sheep-shearing machinery; chaffcutters; drag saws; saw benches; wool presses, etc. — **Paull, Roberts & Parsons Pty. Ltd.**, Sydney, N.S.W., makes milking machines, and also makes rotary vacuum pumps, machine tools and special-purpose machines (to order), tungsten-carbide tipped tools, etc. — **A. H. McDonald & Co. Pty. Ltd.**, Melbourne, Vic., makes milking machines and also makes diesel engines, lighting plants, road rollers, and, occasionally, tractors.

Windmills: There are between twenty and thirty companies which make windmills; however, a few firms dominate this field. The principal manufacturer is **Toowoomba Foundry Pty. Ltd.**, Toowoomba, Qld. (see also "Agricultural Implements and Machinery" above). Other companies important in this field include: **James Alston & Sons Pty. Ltd.**, Melbourne, Vic., which also makes cattle and sheep troughs, pumping gear, tank stands, windmill and lookout towers; **Sidney Williams & Co. Pty. Ltd.**, Sydney, N.S.W., which also makes sheep and cattle troughing, float valves, pumps, water-storage tanks, sheep jetters, winches, prefabricated steel buildings; **Inter-Colonial Boring Co.**, Brisbane, Qld., which also makes pumps, boring tools, spray-irrigation equipment, tanks and tank stands, sheep and cattle troughs, winches, lamb-marking machines, etc.

Fruit Graders: There are two principal manufacturers of fruit graders. Both employ somewhat over 100 persons. One makes fruit-packing plant including washing, drying, polishing, sorting and grading; and also makes fruit-pulping plant, conveyors, stacking machinery, can-lacquering machines, etc. — The other makes sizing and grading plant for fruit and potatoes; citrus washing, sterilising, waxing and polishing plant; fruit, vegetable and coconut dehydrating plant (the only Australian manufacturer); ploughs, weeders, and cultivators, especially for orchards and market gardens; tobacco planters, etc. — About six other companies make small quantities of fruit graders in conjunction with other products.

Spray-Irrigation Systems: There are about fourteen companies in Australia which make main-pipe spray-irrigation systems for agricultural, orchard, market garden, etc., application. **Moffatt-Virtue Pty. Ltd.**, Sydney, N.S.W., makes spray-irrigation systems, orchard and market garden spraying outfits, portable fire-fighters (see also "Milking Machines"). — **Buzacott-Wolseley Pty. Ltd.**, Sydney, N.S.W., makes spray-irrigation systems, portable spraying equipment, irrigation fittings; pastoral equipment (sheep-shearing machinery, rotating power-spray dips, electric-light plants, grain silos); orchard equipment (spray carts, power and hand sprayers); fire-fighter units; agricultural chemicals (sheep dips, weed killers, fly spray and specifics). — **Buzacotts (Queensland) Ltd.**, Brisbane, Qld., makes spray-irrigation systems, power-spray dips for sheep and cattle, and also makes gates and fencing, structural steel, tubular-metal furniture, refrigerators, stoves, electric toasters, etc. — **E. Sacks & Co. Pty. Ltd.**, Brisbane, Qld., makes spray-irrigation plants, and also makes cream cans, wheelbarrows, stoves, electric-water heaters, galvanised hollowware and tinware of wide variety, etc. — **Newell & Co.**, Melbourne, Vic., makes mainly spray-irrigation systems and also makes rabbit fumigators. — **Webb Industries Ltd.**, Kerang, Vic., makes spray-irrigation systems, and also makes windmills, windmill pumps and accessories, galvanised structural steel work for farmers and dairymen, sewerage vent poles, galvanised pole-line hardware for communication and electric-supply services. — **Irrigation Equipment Co.**, Sydney, N.S.W., specialises only on making spray-irrigation systems and accessories. — **Maximum Spray Irrigation**, Sydney, N.S.W., also specialises in spray-irrigation systems only. — **A. Snashall Pty. Ltd.**, Sydney, N.S.W., makes spray-irrigation systems and also makes electric hoists, pumps, etc. — **Rainbow Spray Irrigation Pty. Ltd.**, Sydney, N.S.W., specialises in spray-irrigation systems. — **Intercolonial Boring**

Co., Brisbane, Qld., makes spray-irrigation systems (see also "Windmills"). — **H. Richter**, Qld., makes spray-irrigation plant, and also makes potato diggers; mail huskers, shellers and baggers; potato planters. — **Malloch Bros. Ltd.**, Perth, W.A., makes spray-irrigation systems, and also makes water sprinklers, chaffcutters, feedmills, milking machines, pumps, broadcasters, tanks, troughing, windmill towers, fencing equipment, mining equipment. — **Die Casters Ltd.**, Melbourne, Vic., one of the largest plastics-products manufacturers in Australia (see Chapter 7), also makes spray-irrigation systems. — **Gay (Brickhill) Rotary Sprinklers**, Melbourne, Vic., makes spray-irrigation systems, rotary garden sprinklers, border sprays, etc.

Spraying Units, Mobile (mainly for orchard, market garden, etc.): There are about thirteen firms making spraying units, power, hand, rotary, etc., for orchards, market gardens, domestic gardens, etc. Five of these are also makers of spray-irrigation systems. Products made include tractor or horse-drawn power sprays, rotating power-spray dips (for sheep, cattle, etc.), portable fire-fighter units, hand sprayers, rotary garden sprays, knapsack sprays, etc.

AUTOMOTIVE SERVICE-STATION EQUIPMENT

Hydraulic jacks	} One large company makes a wide range of service-station equipment as a major activity. — About twelve firms (apart from the above) make hydraulic jacks and car hoists. — Several firms make air-compressor units. (See also "Lubricating Equipment".)
Hydraulic air-hoists	
Air-compressor units	
Wheel-alignment equipment, etc.	

BOOT AND SHOE PLANT

Skiving machines	Roughing machines	} About six manufacturers. Two companies make a wide range of items as shown. One of these—British United Shoe Machinery Co. of Australia Pty. Ltd.—is a subsidiary of a large English company with branches in America and other countries, and also manufactures leather and tanning machinery. The other company also makes water meters. The remainder specialise in making certain types of machines.
Perforating machines	Auto-sanding machines	
Pinking machines	Sole moulders	
Parers and trimmers	Latex solution machines	
Stamping machines	Pounder machines	
Finishers	Splitter machines	
Naumkeag machines	Strap cutters	
Scouring machines	Heel-shaping machines	
Clicking and cutting presses	Seat wheel machines	
Edge Setters	Top-piece attaching machines	
Presses of various types		

BRICK, TILE AND POTTERY PLANT

Clay-brick machinery, pug mills, cutters, etc.	} There are several firms which make plant for the production of clay bricks and terra-cotta tiles. These are largely general-engineering establishments and they make to specific order rather than as standard equipment. — One firm makes an automatic machine for the production of concrete tiles within its own organisation, and several other firms make concrete brick and tile machines of the manual or semi-automatic type as standard items. — There are about seven firms making pottery plant. Four of these make a wide range of machines, the rest make only a few types. A number of these firms also make clay brick and tile plant.
Tile machinery (terra-cotta)	
Concrete-brick and concrete-tile machinery	
Pottery machinery	

CHEMICAL AND PHARMACEUTICAL PLANT

Digesters, autoclaves, etc.	} Most of this equipment is made by general engineering establishments which make to specific orders as part of their general activities. In most cases firms tend to confine themselves to types of equipment similar to those undertaken for other industries.
Mixing machines, including vacuum mixers	
Tabletting presses	
Bottling and collapsible-tube filling machines	

CLOTHING PLANT

A world-wide sewing-machine organisation is established in Australia, but its activities apart from assembly, repair and overhaul of its products is devoted primarily to sales and distribution. — One firm is known to be manufacturing attachments for sewing machines. — A domestic sewing-machine head is now being made at the Commonwealth Small Arms Factory, Lithgow, for a company engaged in sewing-machine assembly, maintenance and parts manufacture. — Three firms have made power-operated cloth-cutting machines. — A few firms make pressing machines, benches and some ancillary equipment for clothing plant.

CONSTRUCTION PLANT (not Tractors)

Power shovels, draglines and similar excavators
 Dozer equipment
 Shovel and front-end loaders
 Scrapers (including carryalls) and scoops
 Graders
 Rippers, ploughs, trenchers
 Rollers (road, sheepfoot and other)
 Bitumen mixers, kettles, spreaders
 Road sweepers
 Concrete mixers, spreaders, vibrators, surfacers, etc.
 (Self-propelled and tractor-drawn)

Manufacture in this field is mainly by twelve large firms making the most of the total output, several small firms making a limited range of items. There is significant manufacture under various U.S.A. licensing agreements. — Three firms are making excavators. In addition, three other firms have made these machines. Seven of the above firms and at least five smaller firms make dozer equipment. Seven firms make shovel or front-end loaders up to 2½ cubic yards capacity. — Three large firms make most of the scrapers and scoops, but several other firms make the smaller types. — Three firms make about 90 per cent. of the graders. — Five of the larger firms make a wide range of rippers, ploughs, trenchers, etc. — About two-thirds of the output of road rollers is made by one firm. In addition, there are ten firms which make rollers (powered and drawn) as a minor part of their activities. — Some of the major

firms above also make road-making equipment, three of them being included in the total of seven which are making bitumen equipment. Several firms make bitumen kettles, while more than twenty are producing concrete mixers of various types from hand-operated mixers to large power-driven models. — One large firm makes several types of concrete-laying machines.

FOOD-PRODUCTS PLANT, INCLUDING FOOD PACKAGING PLANT

The manufacture of food-processing equipment as itemised in the following eight sections is closely interrelated and there is frequently considerable overlapping of manufacturing activity from one group to the other.

Baking Machinery:

Dough breaks, mixers
 Cake mixers
 Continuous-batch ovens
 Biscuit cutters, etc.

There are between twenty-five and thirty firms making various types of bakers' machinery and equipment, of which at least twelve make ovens of various types. — Ten firms make various types of dough-making machinery, including mixers, breaks, dividers and moulders. — Several firms make mixers of various types, including cake mixers; and five or six companies specialise in making various types of biscuit machinery.

Butchers' Machinery:

Power mincers
 Sausage machines
 Digesters
 Conveyors, etc.
 Bacon cutters and slicing machines

Four firms make power mincers, and three make bacon slicing and meat-cutting machines. Two make sausage-filling machines. — Several firms are capable of making digesters for the meat industry. — About twelve firms make general-purpose and/or special-purpose machinery and equipment for abattoirs and butcheries.

Canning Machinery:

Can-making and can-sealing machines
 Peelers, pitters, pulpers, juice-extractors, dicing and quartering machines, apple corers, etc.
 Special-purpose machinery for all types of canning

Two large companies make high-speed can-making machines and three other firms make can-sealing machines. — Two firms specialise in a wide range of plant for all types of canning, and will also make to specific requirements. — Several smaller firms make a limited range of equipment either as standard lines or to specific orders.

Cereal Manufacturing Machinery:

Flour-milling plant
 Miscellaneous machinery for cereal manufacture

Three firms are making limited types of machinery for the flour-milling industry. — Six companies, including the three above, are making special-purpose equipment for the manufacture of cereal and similar foods.

Confectionery Machinery:

Mixing machines
 Caramel cutters
 Enrobers
 Wrapping machines
 Cartoning machines

Limited types of confectionery machinery are made by about twelve firms—usually ancillary equipment. One company has made conches, cocoa-butter presses, and other types of machinery to order for a large confectionery manufacturer. Most equipment is made to specific order rather than as standard equipment.

Milk-products Plant:

Milk-Storage vats
 Milk coolers, clarifiers
 Pasteurisers
 Homogenisers
 Can and bottle washers
 Churns and butter-making machines
 Butter cutters
 Cheese vats, curd mills, etc.

About thirty manufacturers. Five are major manufacturers, making a wide range of dairy and buttermaking machinery. (Three of these companies specialise in manufacture of this type of machinery, one is chiefly a manufacturer of sheet-metal products, one also makes fans and air circulators.) — At least twelve companies are primarily sheetmetal-working establishments. — The remainder are either manufacturers of food-products machinery or general engineers making a limited range of dairy and butter-making machinery.

Sugar Machinery:

Crushing plant
Clarification plant
Boiling and evaporation plant
Crystallisation plant

One large company makes a complete range of equipment for sugar-mills and refineries. Several other companies are making individual items, generally to specific order.

Beverage-making Machinery:

Carbonating plant
Wine filters
Distillation vats
Presses, etc.
Bottling plant

There are at least seven firms making machinery for the wine-making industry, of which four specialise in a wide range of equipment. — Five major companies make a range of aerated water machinery, and several others make individual items on a limited scale.

Food-Packaging Plant:

Weighing and measuring machines
Can, bottle, jar, carton and paper-bag filling machines
Carton glueing, gumming and sealing machines
Cellophane container sealing machines
Labelling machines
Sausage-case filling machines
Corrugated fasteners, driving machines and case-strapping machines

There are about fifty firms making and servicing food-packaging machinery. A number of these, making to specification, or making one or two items of food-packaging plant, are general engineers, for whom the activity is not a major one. About ten of the main producers of food-processing equipment make several items of food-packaging plant. Most of these have licensing agreements with companies in U.K., U.S.A. and other major food-processing countries. One or two of these establishments have servicing

and testing departments, designing offices and experimental laboratories, for the benefit of customers. — A few firms, mainly small, specialise in producing individual items, or a limited range of special types of packaging machines. — Fourteen firms make weighing, counting and measuring machines. Two of these, one a subsidiary of a U.K. company and the other with associations in U.S.A. and Canada, specialise in continuous and batch weighing, measuring and counting machines. Another, a subsidiary of a large American food-preparing machinery firm, makes weighing machines. One makes industrial batch-weighing machines, also domestic scales. Another makes weighing and counting machines and three make flow-measuring equipment. The remainder include in their products weighing and measuring machines suitable for food-packaging activities. — Eleven firms make can filling equipment; of these, five large establishments make numerous other food-processing and food-packaging machines. — Twelve firms, including three specialists in milkbottle-filling plant, make bottle-filling and jar-filling machines, and five make carton-filling equipment. — Five large firms make can-sealing plant. — Eleven firms, one a subsidiary of the largest glass manufacturer in Australia, make bottle, including crown, sealing machines and three make jar-closing and screw-cap tightening machines. — Six firms make carton filling, glueing, gumming and sealing machines. One of these, a medium-sized firm, specialises in this activity and is the sole manufacturer of its products, paper and cardboard folding, carton filling, glueing, gumming and sealing machines, in quantity in Australia. — Four firms make plant for heat sealing of cellophane bags, pouches and envelopes. Of these, one also makes 16-mm. projectors and fire-fighting equipment and one also makes electric fires and radiators. — Eleven firms make labelling machines. — Four firms make sausage-case filling equipment; one of these also produces bakers' and pastrycooks' plant, and machinery for the meat industry. — Four firms make case-strapping equipment including corrugated fastener drivers.

GAS MAKING AND RETICULATION PLANT, INCLUDING METERS

Gas Meters: There are five principal manufacturers of gas meters in Australia, two of which are associates of U.K. companies. One company has three manufacturing plants, one each in Sydney, Melbourne and Ballarat, and makes both domestic and industrial gas meters. — One company, which is a subsidiary in a large group engaged mainly in electrical-goods manufacture, has two manufacturing plants, one in Sydney and one in Melbourne, and an assembly and reconditioning plant in Brisbane. — One company, in Sydney, which makes gas meters also makes aviation sparking plugs, milling cutters, cable lugs, and has a 20 per cent. interest in a company making razor blades and a 40 per cent. interest in one making alarm clocks and electric clocks; this company imports many of the components used in its gas meters. — A gas company in Adelaide makes considerable numbers of gas meters for use by its customers. — One company makes gas meters in Melbourne, and also makes water meters and fire alarms, and has an associate company in Sydney making water meters. — Three other manufacturers make gas fittings, one being also a large manufacturer of gas stoves and appliances, the other two also make plumbers' brassware, etc. There are also some small manufacturers of fittings.

Gasholders, Purifiers, Retorts, Washers: Made to order by several engineering firms in various States.

Piping: See "Pipe, Tube and Fittings", Chapter 9.

HOTEL AND CAFE KITCHEN EQUIPMENT, HOTEL CELLAR AND BAR EQUIPMENT

Food mixers and mincers
Stoves, baking ovens, roasting ranges, grillers and toasters
Deep and shallow fat fryers

There are about 140 firms making cafe and hotel kitchen equipment and hotel cellar and bar equipment. Of these, only about 24 specialise in the activities. The largest of the specialist manufacturers make a wide range of pro-

Food-warming, including pie-warming, ovens
 Hot tables, hot presses, bain maries, hot cupboards
 Stock pots
 Boilers
 Tea and coffee urns, and multi-pot tea makers
 Hot-water units
 Butter shapers
 Meat and bread slicers
 Waffle irons
 Ice-cream cabinets and containers; ice-cream spoons
 Refrigeration plant and cabinets
 Soda fountains
 Sinks and sink drainers
 Dish-washing machines and baskets
 Mobile trolleys
 Cool-room refrigeration plant
 Beer compressors
 Beer tapping and extraction equipment, including extractor bodies and extractor rods
 Plastics beer-carrying pipes
 Joiners and nozzles for carrying pipes
 Beer taps, plug and non-drip
 Reducing valves and pressure valves
 Rubber tubes and fittings
 Drip trays
 Glass-washing machines

ducts, the smaller a limited range, or one or two items of equipment only. The activities of the remainder, many of them large establishments engaged in specialised production with strong associations in U.S.A. and U.K., cover a broad field in the electrical and general-engineering industry. With a few exceptions, this latter group's main interest in kitchen equipment is in providing for domestic requirements (see "Domestic Equipment" and "Sheet-metal working", later this chapter). Twenty-two firms make cake mixers and meat mincers. — About nineteen large establishments make stoves for hotels and cafe kitchens. Six of these make electric, gas and fuel types, eleven electric only, one gas only and one gas and fuel stoves. — Eleven firms make baking and roasting ovens and ranges; one of these, owned partly by Australian and partly by United Kingdom interests and another wholly Australian, make almost the entire range of base kitchen equipment for catering establishments. — Five firms make grillers and toasters; seven make deep and shallow fat fryers; and seven make food-warming ovens, including pie warmers. — Four firms, one a producer of stainless-steel hospital equipment and sanitary fittings, makes hot tables, and four make bain maries and hot presses. — Four firms make hot cupboards; nine make stock pots; and four make boiling coppers. — Twenty firms make tea and coffee urns and one, specialising in gas stoves and heating equipment, produces a patented multi-pot tea maker. — Seven firms make hot-water units for commercial kitchen installation. — Two make butter shapers; eight make meat and bread slicers; eight make waffle irons; five make ice-cream cabinets and containers; and four, one of which

makes a patented electrically heated server, make ice cream spoons. — Nine firms make refrigeration plants and cabinets; two of these, one a refrigeration and air-conditioning engineer, specialise in equipment for soft-drink and soda-fountain bars. — Fourteen firms make soda fountains. — Twenty-three firms make sinks. Of these fourteen make stainless-steel, five porcelain-enamel and four both stainless-steel and porcelain-enamel sinks. Of the firms making both types, one is a large producer of plumbers' brassware and builders' hardware, and one has the largest enamelling establishment in Australia, making a number of domestic and commercial kitchen, including hollow-ware, and bathroom products, windmills, tanks and radio masts (see "Domestic Equipment" and "Agricultural and Pastoral Plant", this chapter). One firm in the group, making stainless-steel sinks only, is the main Australian producer of stainless-steel heavy equipment for hospitals. — Eight firms make sink drainers, of these four make nickel and silver types, two of the four also make sheet-iron and enamelled drainers and four make enamelled types only. — Nine firms make dish-washing machines and dish baskets and six make mobile food and dish-carrying trolleys. — About eighteen firms make, instal and service hotel cool-room and instantaneous-refrigeration plant. A number of major establishments, interested mainly in industrial-refrigeration equipment, make the complete plant. A few medium-sized to small specialist engineering firms make ancillary equipment, such as compressors and pressure valves. — Seven firms make beer-extractor bodies and six, including five of the firms making extractor bodies, make extractor rods. — Two large plastics manufacturers make plastics beer-conveying piping in six, eight and ten millimeter sizes. Plastics tubing is now preferred to the old-type metal beer-conveying pipe, as, amongst other advantages possessed, it does not contaminate the product. — Six firms make metal joiners and nozzles for connecting plastics tubing to beer-extraction equipment and eight firms make beer-drawing taps, mainly the new non-drip types, two of the eight make the plug type. Most fittings are made by most major rubber-processing establishments. — There are four main producers of drip trays and eight firms make automatic glass-washing machines. — The breweries generally maintain a service department within their own establishments which undertakes research into problems affecting the marketing of their products by hotels and advises them on equipment, installation and operation, to ensure that their products are presented to standard.

LAUNDRY AND DRY-CLEANING PLANT

Washing machines (industrial)
 Ironers and pressers
 Hydro-extractors
 Drying tumblers
 Solvent filters
 Vacuum stills, etc.

There are between eight and ten manufacturers of laundry and dry-cleaning machinery, of which six produce a more or less complete range of equipment, either as standard lines or to meet specific orders. (Some of this equipment is made under American licences.) The remainder specialise in the production of individual items.

METALWORKING PLANT

General Plant:

Bending machines
 Presses—mechanical, manual and hydraulic
 Shearing and punching machines
 Forging machines
 Guillotines, etc.

Three large companies make a wide range of presses, guillotines, and other types of metalworking machinery. — In addition, between eight and ten other firms, usually small to medium-sized general engineering establishments, make a limited range of equipment of a generally smaller nature. — One medium-sized firm makes drop hammers, steam hammers, and pneumatic hammers under licence to

an overseas organisation (and are also to make forging presses), while five or six others make a limited range of forging equipment. — Many firms, including those mentioned above, have produced or are producing hydraulic presses for various purposes. A large proportion of these are made for the plastics-products industry (see Chapter 7, and "Plastics Machinery", below).

Machine Tools: There are about eighteen companies in Australia making machine tools. A considerable number of engineering firms made machine tools during the war, but have now reverted to other types of products. Seven firms are important makers of machine tools; six are of lesser importance, but make considerable quantities; five firms make only limited quantities. — **McPherson's Ltd.**, Melbourne, Vic., by far the largest Australian manufacturer of black bolts and nuts, also making pumps of all types, has two subsidiary companies making machine tools. One makes engine lathes up to about 24 in. centre, capstan lathes ("Ward 2A" type), shaping machines and hack-saw machines. The other makes 4½-inch lathes, bench and upright drilling machines and tool-and-cutter grinding machines. McPherson's Ltd. have three other subsidiary companies, one in New Zealand making bolts, nuts, rivets, etc., the others making twist drills, taps and dies, milling cutters, reamers, screwing tools, etc. In addition, the company holds a substantial interest in four other companies—one, with A.G.E. Pty. Ltd., making tungsten-carbide tools; one, with The B.H.P. Co. Ltd. and a U.S.A. company, making files and similar small tools; one, with a U.K. and two U.S.A. companies, making abrasives; and one, with a U.K. and some other Australian companies, making precision bushed roller chain. McPherson's Ltd. are also important merchants and importers of machine tools, handtools, and associated items. — **Purcell Engineering Co. (1940) Pty. Ltd.**, Sydney, N.S.W., makes lathes and shapers, and is associated with a machine-tool merchanting company. — **Nuttall Engineering Pty. Ltd.**, Sydney, N.S.W., makes precision 6½-inch and 8½-inch centre lathes. — **Pauer and Co. Pty. Ltd.**, Melbourne, Vic., makes a variety of precision-grinding machines, including plain cylindrical, surface, centreless and other types. — **Mars Machine Tool Manufacturing Co. Pty. Ltd.**, Brisbane, Qld., makes lathes; boring, planing, shaping and drilling machines (and also makes diesel and steam engines, gears, printers' machinery—to order). — **Qualos Machine Tools Pty. Ltd.**, Melbourne, Vic., makes lathes, gear-hobbing machines, and fine boring machines. — The range of machine tools made by the six "medium" companies includes small lathes, drilling machines (one firm, also making woodworking machinery); drilling and lapping machines (one firm, also making metal-working machinery); lathes and slotting machines (one firm, also largely engaged in the reconditioning of machine tools); small lathes and surface grinders (one company, associated with a machine-tool merchanting company); drilling machines, tool-and-cutter grinders, high-speed milling attachments, power-hacksaw machines (one company, also associated with a machine-tool merchanting company); drilling machines and gear cutters (one company, also making universal joints, spare parts for agricultural implements and tractors). — The five firms which make only limited quantities of machine tools each make only one or two types of machine tools, and in total make small lathes, drilling machines, tapping machines, tool-and-cutter grinders, grinders and polishers, shaping machines; a few also recondition machine tools; two make machine tools only as a lesser part of their activities (making mainly motor-repair trade equipment, and wood-working machinery, respectively). — In addition to the above firms, a number of precision-engineering shops are capable of making machine tools, and will, if orders or capacity are available, make them.

Tools and Accessories for Machine Tools and Metal-working Machines:

Drills, reamers, taps, etc.
Chucks (lathe, drill, magnetic)
Tool holders
Machine vices
Tapping attachments
Dies (cutting, forming, etc.)
Jigs and fixtures
Milling cutters

Five firms make cutting tools of various types while, in addition, three make a range of chucks and three make toolholders. A number of other firms, mostly small engineering establishments, make individual items such as machine vices, grinding head, toolpost grinders, etc. — Numerous engineering shops undertake the manufacture of dies, jigs, fixtures, etc., to specific requirements. — Three firms sinter tungsten-carbide tool shapes and two of them also grind to tips and forms; two others grind hard-metal tool tips and formes.

Welding Plant (other than Electrical):

Oxy-acetylene generators
Torches, etc.

There are three manufacturers of this welding plant in Australia. One company (associated with British Oxygen Co. Ltd., England) makes a complete range of equipment (and is also associated with the manufacture of electric-welding machines and electrodes). Two other small companies make a limited quantity of equipment. (For electric welding equipment and electrodes, see Chapter 11, "Electrical and Electronic Products".)

MINING PLANT

Trucks, skips
Cages
Conveyors
Winders and hoists
Head frames
Ore breakers
Coal cutters and loaders
Dumpers
Diesel and battery locomotives
Batteries

Many manufacturers in each State, mainly old-established general-engineering firms, make equipment for the mining industry, particularly for metalliferous mining, either as entire equipment and/or as spare parts, mainly to specific orders. There is a good deal of interrelation of activity between this field and the making of crushing and screening equipment and of general purpose machinery such as pumps, compressors, materials handling plant. — Some mining companies have their own workshops for overhaul and repair work and for manufacture of some equipment and spare parts. — A number of firms make deep-well pumps, reciprocating or multi-stage centrifugal types; one firm makes

Diamond and percussion drilling plants, drills and bits, drill replacement parts
 Deep-well pumps
 Ventilation machinery
 Wire ropes

"Pomona" pumps under a U.S.A. licence. — Several firms make deep-drilling plant, two firms being predominant in this field making plant to drill to 3,000 feet. — There is manufacture of drills, bits and reamers and rock-drill replacement parts by several firms. — Power borers for coal are made. — The B.H.P. group is making battery locomotives (up to ten-ton), coal cutters and loaders for its own use. — One Victorian firm is making diesel locomotives up to a nominal

weight of 25 tons. — Several firms make winders and hoists, one Victorian firm specialising in electric hoists for mining. — There is substantial manufacture of ventilation plant including manufacture of "Sturtevant" equipment under U.S.A. licence. — A few firms specialise in safety devices for mining. — Manufacture of electrical gear for mines, including flameproof and drip-proof motors, is well catered for. — Wire ropes for mining (and other uses) are made by a B.H.P. subsidiary company (see Chapter 9).

OIL-REFINING PLANT

Only a few firms, fabricating piping and tanks to special orders. A large engineering company in Victoria recently made a fractionating tower for one of the oil-refining companies.

OFFICE AND SHOP EQUIPMENT

Office Appliances:

Addressing machines
 Duplicators—rotary
 Stapling machines
 Pencil sharpeners

One large distributor of office appliances makes two models of hand-operated addressing machines under licence to a United States organisation. — One small company makes two models of rotary duplicators, and also carries out the manufacture of replacement parts for all brands of duplicators. — One company, a major manufacturer of office requisites—drawing pins, letter clips, paper binders,

"Monarch" file metal components, etc., makes a hand-operated desk stapling machine. — A large company chiefly engaged as paper merchants have had made for them two models of hand-operated rotary pencil sharpeners. — In addition, all major distributors of typewriters, cash registers, adding and calculating machines, etc., carry out repairs and arrange for manufacture of certain minor replacement parts.

Display Stands (including):

Ticket stands and holders
 Counter layouts
 Keyhole strapping, brackets, etc.

Five firms are known to specialise in the manufacture of metal display stands and similar shop fittings. — Two companies make a range of these items, one also makes builders' and cabinet makers' hardware. — Three other companies make shop and office fittings of various types and designs.

Hairstressing Equipment:

Barbers' chairs
 Permanent waving machines (non-electric, cold and machineless machines)
 Driers

Only one manufacturer of barbers' chairs, also makes dentists' chairs. — Three major manufacturers of permanent waving (non-electric) machines, cold waving and machineless waving machines. All three companies also make hair driers.

Slicers—Bread, Meat: Five manufacturers, one company makes slicers (hand and electric), cake mixers, dial scales and similar items. — One other company, a branch of a United States organisation, makes a range of food machinery including slicers, dough breaks, juice extractors, scales (dial and fan face types) and potato peelers. — One company, primarily a manufacturer of electrical appliances, also makes slicers. — Two other small companies have made slicers; one of these firms is arranging to make fan-face type scales.

OPHTHALMIC AND OPTICAL GOODS PLANT

Edging, surfacing and polishing machines
 Grinding and polishing laps
 Dry heaters
 Thickness calipers
 Lens measures

Twelve manufacturers, all precision engineers and toolmakers, make ophthalmic and optical machinery and equipment in addition to other activities.

PAINT AND PRINTING-INK PLANT

Mills—ball, pebble, jar, roller (chilled iron or granite), cone, flat stone, edge runner
 Vertical, pug, dough and batch mixers
 Can ladders
 Paint strainers
 Filter presses
 Varnish pots
 Tanks and trucks

One firm, in Sydney, has specialised in the manufacture of a fairly complete range of paint-making equipment and supplies the major part of the Australian demand. — In addition there are about 12 firms making similar items as part of their general-engineering activities. — Only one engineering establishment, in Melbourne, has specialised in the manufacture of printing-ink making machinery. (Printing-ink machinery is generally similar to that used for paint making, and includes roller-mills and mixers.)

PAPERWORKING AND PRINTING PLANT

Paperworking and Bindery Machinery:

Pasters for solid-fibre container-board and for pasteboards
 Sheeters; and slitters and rewinders
 Coaters, for varnishing, waxing, glueing, carbon, with auto-feeders and deliveries
 Embossers, creasers, grainers, crepeing machines
 Cardboard-box machinery, including rotary cutter-and-scorers, slitters, corner cutters and slotters, corner stayers, glueing machines
 Tubemaking machines
 Carton-making machinery: Automatic folder and gluer, cigarette-packet shell and slide machines
 Paper-bag machines, flat and satchel
 Stationery-making machines, including envelope, exercise-book, writing-pad, tags
 Guillotines, powered auto-clamp and hand-lever
 Bindery machines and equipment, including casing-in, casemaking, grooving, backing, glueing, tipping, book presses, corner cutting, folders, auto-gatherer/stitchers (with imported stitching heads), automatic continuous three-knife trimmer (for use with auto-gatherer/stitchers), sorters, collating tables, conveyors and conveyor driers, joggers, bundling presses, banders

Composing and Stereo, etc., Equipment, Litho-Platemaking Equipment, Printing Presses, Ruling Machines:

Composing equipment, including case type, type cases and cabinets (wood or steel cabinets, wood cases; also printers' woodware generally), composing sticks, slug-cutters and miterers, trimmer-saws, length and height gauges, chases, quoins, quoin-keys, proof-presses, including register presses.
 Stereo and electrotyping equipment, including melt-furnaces, casting boxes (flat and curved), back-planers, edge-planers, hydraulic matrix-presses, baths for nickel and copper coating
 Litho-platemaking equipment: Multiplate photo-composing machine (made by an offset/lithography printing company), rotary plate-grainers, whirlers
 Presses: Letterpress—small reel-fed rotary news, magazine, racebook, etc., and ticket presses; reel-fed flatbed magazine presses; automatic flatbed stop-cylinder press; aniline printers. Offset/lithography—tinplate printers. Dry-offset—multicolour presses for specific-purpose printing. Automatic sheet feeders and extension deliveries
 Ruling machines of the disc type

There are eleven manufacturers either specialising or tending to concentrate on the making of various items of plant for either or both the paper-converting trade and printing trade. They are all small to medium-size engineering establishments. At least two have direct technical associations with leading U.K. manufacturers of their products; both these companies are prominent in manufacture of their products in Australia—one in cardboard and container-board boxmaking plant, the other in letterpress rotary presses (this latter company has become a subsidiary of the U.K. company). Each of the other nine companies has become the main or only manufacturer in Australia of certain items of plant in its range. — About nine additional engineering concerns make various items as a minor and irregular portion of their general-engineering activities. — There are, in addition, small companies and businesses which specialise in general maintenance and repairs for the paperworking trade and printing trade; the larger capital cities each have several, and the smaller capital

cities a few. — There is only one manufacturer of "foundry" case type in Australia, a printing-trades supply house which is also a principal maker of printing ink and of printing-press inking roller composition in Australia. Case type is also supplied by several establishments, mainly trade compositors, equipped with either "Monotype" or "Thompson" casters, mainly "Monotype". — Printers' and bookbinders' woodware is made by two specialist manufacturers of such, including type cases and case cabinets; spacing furniture, reglets and cabinets; planers and mallets; book-sewing frames; book-press boards, etc.

PLASTICS PRODUCTS PLANT

Mixing machines
 Heating machines
 Compression-moulding machines
 Injection-moulding machines
 Transfer-moulding machines
 Extruding machines
 Hydraulic pumps
 Timing machines
 Calenders
 Welding and sealing machines
 Button-making machines

There are about 21 firms making machinery for the plastics industry. About four of these make a number of items, the remainder specialise in one or two items only. In addition, a number of general-engineering and jobbing-engineering establishments make plant to specification. — The large plastics-products manufacturers generally have special engineering sections producing moulds and dies for their own requirements and also certain ancillary equipment; at least one has made for itself a range of processing plant, including extruders. — Seven firms make preheating equipment. One of these, making a number of items of plant for the plastics industry and some of the heaviest machine units made in Australia for mining,

railways, shipping, rubber processing and steel fabrication, also makes mixing mills. — Eight firms make compression-moulding presses. Two of these specialise in hydraulic engineering. One making compression-moulding presses of 50, of 100 and of 500-ton capacity also makes other special machinery including woodworking and food-processing machines. Another makes presses of 10 to 1,000-ton capacity. One, also making moulding presses, makes electric and hydraulic lifts and travelling cranes. Another is the largest sheetmetal-working machinery manufacturer in Australia. One firm, a subsidiary of a U.S.A. food-processing machinery manufacturer, is also an important producer of plant for the food industry, and another also makes food-canning and food-packaging machines. — One firm makes injection-moulding machines, two make transfer-moulding machines and three firms make extrusion machines. — Five firms make hydraulic pumps, one firm makes calendars, and four welding and sealing machines. — Three firms, one the largest button-making establishment in Australia and one mainly engaged in woodworking machinery, make button-processing machines.

PULP, PAPER AND PAPERBOARD PLANT

Barking drums
Chippers
Grinders
Refuse hoppers
Lime kilns
Causticing equipment
Digesters
Digester agitators
Evaporators
Stock pumps
Concentrators
Stock washers
Foam breakers
Flat screens and bull screens
Screen flow and delivery boxes
Refiners
Thickeners
Beaters (hollander) and bars
Couch, extractor and wash rolls and mountings
Vats and moulds
Cylinder valves
Drying cylinders
Mill slitters and rewinders
Mill sheet-cutting guillotines
Broke breaker

Items of plant as shown at the left for the making of paper-making pulps from pulpwood by both chemical and mechanical processes and from straw and wastepaper are made in Australia. Fourdrinier and cylinder machines are not made in Australia, neither the wet end nor the dry end, including calender stacks. Lapping machines are not made in Australia. Practically all items of papermaking plant made in Australia are made to specific order of one or other of the four companies engaged in paper and paperboard manufacture in Australia (see Chapter 4), sometimes to overseas licences obtained by the manufacturer, sometimes to overseas licences obtained by the papermaking company. Drying cylinders up to 96-inch deckle and 42-inch diameter have been made, mainly by one large general engineering company. The principal companies engaged in the manufacture of pulping and papermaking plant in Australia include the following companies. **Vickers Ruwolt Pty. Ltd.**, Melbourne, Vic., which is associated with Vickers Ltd., U.K., is a large heavy engineering company which makes a wide range of industrial equipment. Pulp and paper-making machinery made by this company include: Ancillary equipment, including Hollander beaters, Jordan refiners, under licence from Walmsley's Ltd., U.K.; brown stock vacuum washers, 3-stage; foam breakers, digester blow-tank agitators, flat screens and bull screens, under licence from the Improved Paper Machinery Corp., U.S.A. On behalf of

Australian Newsprint Mills Ltd., which has obtained the necessary overseas manufacturing licences. Vickers Ruwolt Pty. Ltd. have made six of the Great Northern pocket-type grinders, stones of 62-inch diameter, 54-inch face, with 1,800 horsepower motor (under licence from Montague Machinery Co., Turners Falls, Mass., U.S.A.); six Tidmarsh ring-type grinders, with stones of 62-inch diameter, 54-inch face, with 2,500 horsepower motor; and refuse hoppers (under licence from the Sumner Iron Works, Everett, Wash., U.S.A.). For Australian Paper Manufacturers Ltd., which has obtained the necessary overseas licences, Vickers Ruwolt Pty. Ltd. has made a number of 48-inch Sutherland refiners. The company also makes barking drums, of 10-foot diameter by 30 feet in length; and mill slitters and rewinders up to 190 inches wide. — **W. Anderson and Sons Pty. Ltd.**, Melbourne, Vic., makes, under licence from Bertrams Ltd., U.K., Hollander beaters; and has also made flat screens and bull screens, and a broke breaker. (This company also makes brick and tile making machinery and rubber machinery.) — **Smith and Searls Pty. Ltd.**, Melbourne, Vic., makes a range of papermaking machinery including vats and moulds, cylinder valves, thickeners, 10-plate and 12-plate screens, Trimby screens, Cowan screens, couch, extractor and wash rolls and mountings, screen flow and delivery boxes, agitators, stock concentrators, beater bars, whippers, Jordan plugs. This company has a licence from the Canadian Hydraulic Machinery Co. for manufacture of papermaking machinery. (Smith and Searls Pty. Ltd. also makes food processing and packaging machinery.) — **The Commonwealth Ordnance Factory**, Bendigo, Vic., made two 60-inch mill sheet-cutting guillotines for one large paper manufacturer, and also some drying cylinders. — **Perry Engineering Co. Pty. Ltd.**, Adelaide, S.A., manufacturers of materials handling equipment, excavators, cableways, winches, sugar mill locomotives, etc., and structural engineers, has made drying cylinders, 36-inch diameter by 9 ft. 6 inches long. — **Hobart Duff Pty. Ltd.**, Melbourne, Vic., is primarily a distributing agency, but has a subsidiary company making, among other things, papermaking plant, including Dorr-Oliver type rotary washers and brown-stock washers, and causticing equipment. — **Thompsons Castlemaine Ltd.**, Castlemaine and Melbourne, Vic., one of Australia's largest engineering companies and making a wide range of industrial equipment, has made Swensen evaporators for one of the large paper manufacturers under licence from the Swensen Evaporator Co., Illinois, U.S.A., and also makes stock pumps for handling paper stock of high consistency. — In addition to these companies there are at least three other companies which make stock pumps specifically for the papermaking industry.

RUBBER-PRODUCTS PLANT

Calenders
Mixers
Extruders
Colloidal mills
Trimmers
Spreaders
Vulcanisers

One large general-engineering firm (a subsidiary of a United Kingdom company), in Victoria, makes a wide range of rubber-working machinery for the processing of rubber, the making of tyres and tubes, etc., including large extruders (the only manufacturer in Australia), hydraulic presses, autoclaves, and other rubber plant. This company also makes machinery for the mining and paper industries. — Another large general-engineering firm, in N.S.W., makes extrusion presses, calenders, mixers and other general plant for the rubber industry. This company also makes hydraulic presses, mining equipment, cranes and general-engineering plant. — One medium-sized general-engineering firm, in Victoria, makes a wide range of extruders up to 8 inches for the rubber and plastics industry (the only manufacturer of small extruders in Australia), mixing machines, spreading machines, colloidal mills, trimming machines, and various other items for the rubber industry. This company also makes machinery for the meat, chemical and other industries. — One medium-sized general-engineering firm, in Victoria, making machinery for the clay brick and tile, paint, cocoa and chocolate, mining and papermaking industries, makes spreaders, vulcanisers, mixers and rubber-hose machinery for the rubber industry. — Tyre moulds are made mainly by the tyre-making companies, all of which operate engineering shops for main-

tenance, manufacture of frequently replaced items of equipment and, on occasions, various items of machinery and plant.

Tyre Retreading and Repairing Machinery: There are four manufacturers of tyre retreading and repairing machinery. Three of the manufacturers are themselves engaged in tyre retreading and repairing. Two of these companies, one of which is the only maker of large tractor-tyre retreading equipment, supply the major part of the equipment.

(Most of the rubber machinery produced is made to order and not as standard lines.)

SMELTING AND REFINING PLANT

Crushing and grinding machinery
Concentrating equipment, flotation cells
Vibrating screens
Classifiers
Magnetic and electrostatic separators
Washers, filters, thickeners, tanks, cyanide vats
Roasters, kilns, smelting furnaces
Electrolytic cells

See also "Mining Plant", "Crushing and Pulverising Plant", "Moving, Handling and Hauling Plant", and "Screening Plant", this Chapter. All except the largest sizes of crushers and mills for mineral treatment are made in Australia by a number of general-engineering firms. Some special patented machines are imported from the U.S.A.

SOAP AND WASHING-POWDER PLANT

Soap kettles
Crutching machines
Cutting frames
Milling, plodding, extruding, stamping, wrapping and packing machines
Spray and roller driers

Soap machinery is made to order by eight Australian engineering firms. One of these, a large N.S.W. firm prominently engaged in building of ships, ship engines and ship steam-raising plant, in ship repair and in general engineering, is licensed to make the soap-making plant (and other types of machinery) of a leading U.K. industrial organisation, of which it is a subsidiary company. — Probably less than half the demand for soap machinery is supplied by local manufacturers; most machines being supplied from Britain.

TANNING AND LEATHER-WORKING PLANT

Head splitting and cheeking machine
Conditioning and scowing machine
Electric ironing machine
Plating and embossing machine
Unhairing machine Belly-setting machine
Fleshing machine Shaving machine
Scudding machine Staking machine
Frizing machine Glazing machine
Sammying machine Boarding machine
Setting Machine

Four companies make leather and tanning machinery, two of which make a wide range as shown. One of these, British United Shoe Machinery Co. of Australia Pty. Ltd., is a subsidiary of a large U.K. company and also makes boot and shoe machinery. — There are also a few smaller firms which make special parts for leather and tanning machinery.

TEXTILE PLANT, INCLUDING FIBRE PROCESSING PLANT

Opening, teasing, cleaning, dusting machines
Flock-making machines
Scutching machines
Fur-processing machines
Wool-preparation machines
Carding machines
Textile Wires
Topmaking machines
Spinning machines
Knitting machines
Warping and beaming machines
Looms
Bleaching machines
Dyeing machines
Printing machines
Finishing machines

There are about 74 firms making textile and fibre-processing plant, remodelling and repairing textile machinery and making ancillary equipment for textile plant. A number of these, making textile plant to specification, are mainly concerned with equipment other than that for the textile industry. Most of the larger firms, making textile machinery only, make several items of plant for various sections of the industry. A few firms, mainly small, specialise in the manufacture of individual items, or of a limited range of special types of equipment. Many of the large textile establishments have their own engineering works for repairing and converting equipment; some also build new machines. As well as those firms making general textile equipment, some of which is suitable for fibre processing, about eight manufacturers specialise in making machinery for fibre processing. — One firm makes opening, cleaning, teasing and dusting machines; one makes opening, teasing and dusting machines; another makes opening and teasing machines. — Four firms make flock-making machines; two make carding machines; one makes scutching

machines for the flax industry; and one firm, mainly a tubular furniture manufacturer, makes fur-processing equipment. — Nine firms make wool-scouring plant, and two firms make wool-carbonising plant. — Ten firms make drying plant, including hydro-extractors. Those making the latter are engaged mainly in the manufacture of laundry and dry-cleaning equipment. — Three firms make crushing and grinding machines, and three make carding machines. — One large wire-products manufacturer makes all types of wires for textiles machines. One manufacturer only makes card clothing. This company is a subsidiary of a U.K. firm and an Australian company which is one of the largest importing, exporting and merchanting firms in Australia, dealing in a very wide range of merchandise, including wines and spirits,

machinery, particularly textile machinery, paper and paper products, soft goods, etc., and which has another subsidiary making elastics. — One firm makes burring machines and one firm makes rollers. — Two firms make comb circles, another makes spindles. — Seven firms make bobbins. One, making plastics bobbins, is a subsidiary of a large manufacturing and merchanting firm distributing dyestuffs, solvents, chemicals, resins, plastics, textile machinery and engineers' supplies from overseas; also having subsidiaries making paints and enamels, laundering and dry-cleaning plant. Another, also making paper cones, tubes, spools and pirns, is an associate of an overseas company (reported to be the largest manufacturer of textile paper accessories in the world) and of two large paper-converting establishments, one of which also engages in printing. — There are two makers of sliver cans of vulcanised fibre, both makers of travel goods, one being one of the largest manufacturers in Australia of trunks and cases, bags, satchels, etc. — One firm makes doubling and twisting machinery and seven make winding equipment. — Two firms make conditioning plant.

Two firms make knitting machines, one firm makes accessories for knitting machines and one produces replacement parts. — Seven firms make warping and beaming equipment. — One firm makes inspection machines. — Four firms make stop motion and control equipment and three firms make reads, two of the three also making healds (the only manufacturers in Australia, using imported twisted wire). — Four firms make looms. One of these, a small company, makes looms for hand-craft work, as well as commercial looms. Another firm, also small, makes looms for weaving wool rugs. One manufacturer makes replacement parts for looms and one makes shuttles. — One firm makes bleaching plant. — Four make dyeing plant and one makes dye jiggers. — Two firms make brushing machines and two firms make slipping and levelling machinery. — Three firms make testing and measuring equipment. — One small firm, also making furniture to individual design, makes screen frames for textile printing. Most textile printing establishments make their own frames and screens; other equipment for screen printing is made to specification by jobbing engineers.

TOBACCO-PROCESSING PLANT

Various items of accessory equipment are made, usually to specific order of the tobacco-products companies. (Practically all tobacco-products machinery is imported.) An engineering company in Queensland recently made some tobacco-processing equipment for a Queensland tobacco-products establishment.

WOODWORKING PLANT

Planers and thicknessers
Dovetailing machines
Shapers and moulders
Sanders
Saws (circular, band, etc.)
Veneer-peeling machines

The manufacture of woodworking machinery is covered by about twenty firms, of which six make a wide range, both to standard designs and adaptations to suit individual requirements. Firms engaged in the manufacture of a wide range of woodworking machinery usually confine their activities to that field. — The remainder specialise in one or two lines which are generally produced as standard items.

PLANT OF A GENERAL NATURE

In this section there are set out the principal types of plant made in Australia for widespread general application (and thus used in most manufacturing activities and, in some instances, for domestic purposes), the approximate number of manufacturers, and information about other products or significant associations of a manufacturer where appropriate. The types of plant are—

- Air-conditioning Plant
- Air-compressing Plant and Pneumatic Tools
- Crushing and Pulverising Plant
- Cutlery and Saws
- Engines—Internal-combustion (Stationary and Boat) and Steam (other than Locomotive and Ship)
- Fans and Blowers
- Fire-protection Equipment
- Fixtures, Shelves, Furniture, of Metal
- Furnaces and Ovens
- Handtools
- Hardware Not Elsewhere Included
- Lubrication Equipment
- Moving, Handling and Hauling Plant (other than primarily Transport Equipment)
- Packing-room Plant (other than Food Packaging)
- Power-transmission Equipment, including Bearings
- Pumps
- Refrigeration Plant
- Screening Plant
- Steam-raising Plant
- Valves
- Water Meters
- Weighing Plant (other than Shop Scales)

AIR-CONDITIONING PLANT

Filters, dust and grit arrestors
Humidifiers and dehumidifiers
Heating and cooling coils
Ozonators
Central-heating systems
Unit conditioners

There is a strong connection between this and the refrigeration group, in that of the nine firms mentioned as predominant in that field, six also make a wide range of air-conditioning equipment including complete plants for cool stores, hosiery mills, blood banks, telephone exchanges and similar installations. The two largest organisations in this field, Carrier Air Conditioning Ltd. and York Air Conditioning and Refrigeration (A'asia) Pty. Ltd., are associated

with leading U.S.A. manufacturers. These larger organisations are supported by numerous smaller firms which interest themselves only in limited applications such as central heating, dust control and ventilation; these latter companies are frequently sheetmetal-working establishments which purchase essential items from suitable manufacturers and then assemble the complete plant to suit specific requirements.

AIR-COMPRESSING PLANT AND PNEUMATIC TOOLS

Compressors: There are twenty-six known manufacturers of compressors of various sizes. Five of these, including two which are branches of overseas manufacturers of pneumatic equipment, make the larger industrial types, while three also make mobile units. The remainder are mainly concerned with single-stage and two-stage low-pressure units of the type used for automobile-service stations, paint spraying, small-tool drives, etc. In addition, two other firms assemble portable compressor units using local or imported compressors and imported power units. Three of the larger compressor manufacturers also make a wide range of pumps.

Pneumatic Tools: There are six firms in Australia engaged in the manufacture of pneumatic tools, chiefly the smaller portable handtool types (see "Portable Tools"). Manufacture of the heavy-duty type equipment is confined to replacement parts, the initial equipment being imported. — Two of the firms engaged are associated with American organisations of world recognition. Both companies make a range of portable and stationary air compressors. One of these companies also makes sump pumps in two sizes, air-operated hoists in six sizes, jack hammers (including pistons and cylinders), centrifugal pumps, after coolers, oil-fired furnaces, and general accessories and replacements for their pneumatic tools. The other company also makes sump pumps, electric high-frequency grinders, hose connections and general accessories and replacements for pneumatic tools. — Of the remaining four companies, one makes paving breakers, hammers, pick and clay diggers; a second company makes sanders, drills, polishers, grinders, vibrators and hammers; a third makes a range of pneumatic tools for use by stone masons, namely, plug drills, surfacers, and also makes air-operated paint mixers, bench-model and floor-model rivetting machines; the remaining company makes small polishers and grinders. There are several other companies which make accessory items such as hose connections, pistons, etc., as part of their general activity.

CRUSHING AND PULVERISING PLANT

Jaw, gyratory and roll crushers
Hammer, stamp, ball, pebble mills
Pulverisers

One large general-engineering firm specialises in the manufacture of a wide range of crushing equipment, while there are several firms producing various types of grinding mills for general purposes. — Three large general-engineering concerns make jaw and cone crushers to order; one of the companies, a subsidiary company of a leading U.K. engineering

company, makes the largest jaw crushers made in Australia. — Several firms are making cereal mills. — Generally speaking, the larger firms in this group also produce mining machinery.

CUTLERY AND SAWS

Cutlery—Table knives of stainless steel, carving and bread knives, industrial and other knives: Two companies make stainless-steel table knives; one of these, associated with The B.H.P. Co. Ltd., is also the principal manufacturer of files in Australia; the other makes a wide variety of knives. — Six other firms are making various kinds of knives, including butchers', fruit, paring and industrial knives. There is interrelation of activity between the manufacture of industrial knives, saws and other edged tools.

Razor Blades: One company makes razor blades (with associate companies making alarm clocks and aviation sparking plugs).

Circular Saws: Several firms including a well-known U.S.A. company are making circular saws from either locally-produced or imported saw blanks. These firms also carry out sharpening and reconditioning and one company also produces a wide range of industrial knives.

Hacksaw Blades: One company is producing hacksaw blades for handtools from locally-produced steel. The manufacture of power-hacksaw blades by a U.K. organisation is expected to begin late in 1952.

Hand Saws: Three firms are making hand saws from imported steel.

ENGINES

Internal-combustion Engines (Stationary and Boat): About thirteen firms, in the small to medium category, make diesel and crude-oil engines (mainly diesel) of both stationary and marine types, up to 75 h.p. — Some thirty firms, including five of the above, make single and multi-cylinder stationary and marine petrol and/or kerosene engines in ratings up to 28 h.p. Several of these companies either make or purchase auxiliary equipment and, using their own engines, assemble and market combined units such as home-lighting sets, pumping sets, spraying outfits, rotary hoes, shearing and milking machines. (Manufacture of automobile engines is covered in "Motor Vehicles", Chapter 10; diesel and oil ship-engines in "Ship-engine Building", Chapter 10; and tractor engines in "Moving, Handling and Hauling Plant", later this Part.)

Steam Engines (other than Locomotive and Ship): There are a large number of engineering firms which can and, when required, do make steam engines for general industrial purposes. (Steam engines for propulsion of ships are covered in "Ship-engine Building", Chapter 10.)

FANS AND BLOWERS

Exhaust Ventilating Axial flow Gas boosters Forge blowers, etc.	}	At least twenty firms make industrial fans of various types. Of these, ten have a wide range of production which includes certain types of blowers. The manufacture of these items is usually closely allied with that of air-conditioning and similar equipment.
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FIRE-PROTECTION EQUIPMENT

Extinguishers (soda acid and foam types, reversible types, break bottle type, and powder type) Mobile units Knapsack units Sprinkler systems	}	One large manufacturer with subsidiary companies in all States, New Zealand and South Africa, makes all types of fire-protection equipment. — One medium-sized manufacturer established in New South Wales makes mobile units and knapsack units, as well as extinguishers. — Four manufacturers, three in New South Wales and one in Victoria, specialise in sprinkler systems. — In addition to the above, five manufacturers of diesel engines make portable spray units, incorporating their engines, for country fire fighting. — Some manufacturers of hand and power pumps equip these for sale as fire-fighting units.
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FIXTURES, SHELVES, FURNITURE, OF METAL

Tubular-steel tables, chairs, trestles and storage racks, etc. Sheet-steel cupboards, filing cabinets, lockers, etc. Household furniture	}	There are numerous firms making steel furniture for many purposes, the majority producing such items as part of their general activities. Only about six of these establishments can be considered as specialising in the field. One company, considerably engaged in manufacture of fabricated steel buildings, makes on licence from a U.S.A. manufacturer high-grade kitchen cupboard and sink units of steel, with rubber tops. Another company, a major manufacturer of tubular-steel furniture, particularly hospital beds, has made on licence from a U.S.A. manufacturer high-grade bedroom furniture in steel.
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FURNACES AND OVENS

There are ten known manufacturers of oil and/or gas fired furnaces. — One of these companies makes all types of furnaces and industrial ovens (including electric types) and is now associated with a leading U.K. organisation in this field. — Three other firms are of major importance and one of them makes low-frequency induction furnaces under an American licence. Types of furnaces manufactured include melting, heat-treatment, annealing, etc. — The remaining six firms are relatively small and make furnaces in a limited range of types. Oil-fired and/or gas-fired industrial ovens—drying, core-baking, bakery, etc.—are made in Australia by ten companies. Four of these companies also make furnaces, four others make only bakers' ovens, while the remaining two firms make industrial ovens of all types.

HANDTOOLS

Adzes and Pickaxes: One firm is making these items.

Axes: Five firms make axes and three of them also make hatchets.

Bench Screws, Vices, Clamps, etc.: Seven firms make these items, in association with other products.

Bevels, Squares, Gauges: These are made, with associated products, by three major companies.

Bits, Carpenters': One firm only (a subsidiary company of The B.H.P. Co. Ltd.) makes carpenters' bits (also wood chisels and wire products).

Blacksmiths' Tools: Made by several manufacturers, one of which, a large steel-founding and general-engineering firm, makes cast-steel anvils up to 5 cwt.

Blow Lamps, Torches: About six manufacturers, usually also making pressure stoves.

Carpenters' Braces, Hand and Breast Drills: Six manufacturers make these items, in association with other products.

Chisels, Cold: Several companies make cold chisels.

Chisels, Wood: Practically all made by one company (also making auger bits and wire products—see above).

Files: One manufacturer only (associated with The B.H.P. Co. Ltd.).

Hammers: Four or five companies make hammers of both carpenters' and engineering types.

Planes, Carpenters': Three firms are making iron planes, one specialising while the others produce additional lines. — One manufacturer is making wooden planes.

Pliers, Pincers, Nippers, Pipe Cutters, etc.: Two firms make the complete range, while several others produce pliers only.

Screwdrivers: About seven manufacturers—two predominantly important, one of which makes hardware items for the building industry.

Spades, Shovels, Hoes, Forks, etc.: Four or five firms are making these items in association with similar tools.

Spanners: Some types are made by several firms (of which two also figure in the preceding group).

Stocks and Dies: Made by six firms, some of which are also engaged in the making of cutting tools for machine tools.

(Portable electric tools are covered in Chapter 11, "Electrical and Electronic Products"; and pneumatic portable tools in "Air Compressing Plant and Pneumatic Tools", this chapter.)

HARDWARE NOT ELSEWHERE INCLUDED

Builders' and Cabinet Furniture Hardware (General): Several manufacturers specialise, and cover a wide range; other makers produce various lines in conjunction with the manufacture of other hardware. One leading manufacturer of cabinet furniture also makes screwdrivers and handbag frames, steel window-frames, door frames and doors, wrought-iron work and other architectural metal work.

Plumbers' Brassware, Fittings, Hardware, Hose-fittings, etc.: Several manufacturers, some large, usually and mainly associated with the non-ferrous foundry industry.

Locks: Two major manufacturers produce about 90 per cent. of locks made. — One of the companies makes locks under an arrangement with a U.S.A. company with which there is an interchange of personnel and technical data. (This company is also a major manufacturer of builders' hardware, and makes as an interrelated activity medical equipment, masonry anchors and steel flooring.) — The other company operates one of the largest drop-forging plants in Australia and is the major manufacturer of drop-forged hand tools (but is not otherwise engaged in manufacture of hardware.) — Four other companies make small quantities of locks (all of these companies also make builders' hardware).

Handbag Frames and Fittings, Case and Trunk Fittings, Locks, Metal Corners, etc.: Several manufacturers, usually associated with manufacture of general hardware.

Animal Traps: Several manufacturers in wireworking make mouse and rat traps, and five manufacturers of general hardware make rabbit traps.

(See "Domestic Equipment", next section, for other household hardware.)

LUBRICATION EQUIPMENT

Power equipment } One predominantly important company of overseas origin makes a wide
Grease guns } range of all types of lubricating equipment as a major activity. — A
 } large N.S.W. manufacturer of machinery makes industrial lubrication
systems under an American licence. — One other company makes limited types of equipment.
— Two companies, apart from above, make hand-operated grease guns.

MOVING, HANDLING AND HAULING PLANT (other than primarily Transport Equipment and Construction Plant)

Capstans: Three firms make capstans either as standard units or to meet customers' specific requirements.

**Conveyors.
Conveying
Systems:**

Belt
Bucket
Chain
Elevating
Monorail
Overhead
Pneumatic
Roller

There are a number of large engineering companies which make a range of conveyors and conveying systems. In some cases manufacture is associated with other types of materials handling equipment; in others with machinery for a specific industry which requires conveyors—e.g., mining, fruit-grading, etc., machinery. Many of the larger types of conveyors made are a "tailored-to-measure" job. Information regarding conveyor belts of rubber is given in Chapter 8; of leather in Chapter 14; of woven wire later in this chapter. Conveyor chains are referred to in "Chains" later this chapter.

Cranes:

Derrick, jib, gantry
Overhead travelling
Mobile
Hand-operated
Ore bridges
Luffing wharf cranes
Floating cranes

Between twenty-five and thirty firms make various types of cranes, but at least half of these are relatively large organisations making other types of structural equipment. Only two firms specialise in the manufacture of cranes. One of these also specialises in transporters and other types of materials-handling plant. Cranes up to 250 tons lift have been made in Australia.

**Hoists and Hoisting
Equipment:**

Air-Operated
Electric
Hand chain, etc.

At least thirty firms make hoisting equipment of various types. About ten of these make hydraulic hoists for automobile-service stations, while another ten make various models of electric hoists. The remainder confine their attention to hand chain and similar simple types. (See also "Chains", later this chapter.)

Industrial Trucks:

Mobile (battery-electric or i.c.-
engine operated)
Hand-operated (includes trolleys
of all types)

One firm makes fork-lift, platform and other types of trucks, powered by either battery-electric, diesel-engine or petrol-engine. — One other firm makes fork-lift trucks under licence from an American manufacturer. — One of the larger companies, in addition to half a dozen smaller establishments, covers a wide variety of hand trucks and trolleys.

Stacking Machines:

Electric
Hydraulic
Hand-operated

About twelve firms make stacking machines of various types. These are usually power operated for the lift and hand operated for moving about.

Tractors (Wheeled):

Agricultural types
Industrial types

Wheeled tractor production is accounted for by five firms. Of these, four have capacity to make agricultural wheeled tractors, and one makes heavy industrial tractors (mainly two-wheeled types used as prime movers for earthmoving equipment), powered with imported diesel engines. Two of the above firms are associates of large American tractors. The agricultural-type tractors are in the medium and heavy horsepower classes. Both kerosene and diesel types have been made. The industrial wheeled tractors are powered with diesel engines of 100, 160 or 180 horsepower. The largest firm and two other firms also make other agricultural equipment. The firm producing industrial tractors makes other earthmoving equipment. Crawler tractors are, as yet, not made in Australia. There is, however, manufacture of ancillary equipment for crawler tractors and of tractor parts.

Winches:

Power-operated
Hand-operated
Logging
Hauling-up slip
winches
Ship winches

Many firms engaged in the manufacture of materials-handling equipment together offer a wide variety of both power-operated and hand-operated winches; and five firms make logging winches in conjunction with other construction equipment.

PACKING-ROOM PLANT

Filling machines
Labelling machines
Wrapping machines
Cartoning machines
Gumming machines
Nailing and strapping
machines

About twenty firms make various types of packaging machinery. At least half of these also make food-processing machinery, and the activities in that field. — The remaining companies specialise in individual items.

POWER-TRANSMISSION EQUIPMENT

Variable-speed drives
Shaft equipment
Bearings, plain (including sintered)
Bearings, ball
Clutches
Gears
Pulleys, etc.

Numerous firms are engaged in the manufacture of all types of power-transmission equipment. Of these, three make friction clutches, while six produce variable-speed drive units, and many others produce shaft equipment, including pulleys and plain bearings. — Three firms specialise in the manufacture of sintered bearings. — One Government factory produces ball-bearings in a limited range of sizes, and one company makes non-precision ball-bearings. — Several firms are specialists in making gears of various types, including very large drive gears, but only three organisations are equipped to cut gears such as

double-helical reduction gears for ship-turbine drives. — One firm is predominant in the manufacture of split steel pulleys, and a number of firms, including jobbing engineers, produce pulleys for V-belts and rope belts.

PUMPS

There are numerous manufacturers of pumps, including a wide range of hand and power types. Axial flow, mixed flow, single and multistage centrifugal pumps are made by several manufacturers, and at least one manufacturer has made centrifugal pumps larger than 48 inch. Boiler-feed pumps, oil pumps of various types and vacuum pumps are made by several manufacturers. — One major manufacturer of pumps is part of a large organisation which makes machine tools, bolts and nuts, engineers' tools (including files) and wood-working machinery. — Another major manufacturer is associated with a U.K. organisation. — A third also makes compressors, condensers, steam-line equipment and does general heavy-engineering work. — Ten companies make petrol pumps for service stations. — One firm makes a wide range of hand-operated and power-operated grease pumps. — Some of the pump manufacturers market their products in the form of complete pumping units—windmills, irrigation equipment, fruit spraying and fire-fighting units, etc.—either making the ancillary parts or buying them from other makers. — There are at least three firms making vacuum pumps in a variety of sizes, one of which manufactures under licence from a U.S.A. organisation.

REFRIGERATION PLANT

There are about 40 manufacturers in Australia. Of these, about 30 firms are either making and/or assembling domestic refrigerators of both the mechanical (including sealed units) and absorption types. — At least thirty companies, including fifteen mentioned above, make a wide range of commercial refrigeration units. In addition, several small firms assemble units from components, few, if any, of which are made in their own works. — Ten large companies make, apart from certain control apparatus and prime movers, substantially the entire range of equipment and component parts for the construction of industrial refrigeration units. (Three of these companies also make commercial units.) — Two large companies make mobile refrigeration units (one of these companies is not otherwise engaged in refrigeration manufacture; the other makes all types of commercial and domestic units). — In addition to the above, several companies specialise in the production of component parts for refrigerators such as cabinets (commercial and domestic), evaporators, condensing units, thermostatic expansion valves and associated items. A number of well-known overseas makes of domestic and commercial refrigerators are made either under licence by Australian manufacturers or by associates of overseas companies operating in Australia.

SCREENING PLANT

Trommel
Shaking
Vibratory
Sifting, etc.

There are five major manufacturers of screening equipment, and several others produce a limited range of special types.

STEAM-RAISING PLANT

Boilers:
Pressure
Locomotive
Other

There are four companies in Australia which build high-pressure boilers for electricity generation, etc. Boilers are made in pressures of up to about 1,500 p.s.i. Three of these companies are associated with United Kingdom manufacturers of boilers. Certain components, particularly headers, drum ends, superheater and mud-drum boxes, and some types of tubes, are imported for incorporation into boilers built by these companies. One of these four companies also makes, concurrently, water-tube marine boilers; and all can make low-pressure

boilers if they have spare capacity from their high-pressure boiler activities. (Marine boilers are covered in "Ship-engine Building", Chapter 10.) — Numerous companies are capable of making low-pressure boilers, up to about 200 p.s.i. steam pressure. Six of these, and three State Railways Departments, make locomotive boilers. (A number of boiler manufacturers also make similar equipment such as pressure vessels, autoclaves, stokers, steam-line equipment, etc.)

Stokers: There are four major companies engaged in the manufacture of mechanical stokers and boiler-firing equipment. All are subsidiaries of important overseas organisations which specialise in the construction and erection of complete steam-generating plant of all types and capacities for power stations and other projects. — Four other firms specialise in the manufacture of

mechanical stokers on a smaller scale. — Several engineering firms also make stokers for handling waste products such as bagasse.

Condensers: Thompsons (Castlemaine) Ltd., a large general-engineering company with two establishments, both in Victoria, makes condensers for all major power-station installations throughout the Commonwealth. This company is also a major manufacturer of pumps, compressors and steam-line equipment. Four other organisations, Walkers Ltd., Maryborough, Qld., Morts Dock and Engineering Co. Ltd., Sydney, N.S.W., the State Dockyard, Newcastle, N.S.W., and Kelly and Lewis Ltd., Melbourne, Vic., (the first three of which are also shipbuilders) which also have extensive engineering shops, make condensers for power-station use. — Condensers for ships are made by shipbuilding establishments (see "Ship-engine Building", Chapter 10) and by a few general engineers and some boilermakers.

VALVES

Gate, Globe, Pressure and Special-type Valves: Several firms make a wide range of valves of all types. Some additional firms, mainly general engineers, make special valves to purchasers' designs. Of these there are four which can be considered of particular importance. The manufacture of valves is closely allied to the non-ferrous foundry industry and also to the manufacture of plumbers' brassware.

WATER METERS

There are about seven principal manufacturers of water meters, three of which are associated with one another. One of the largest companies, at Sydney, is a subsidiary in a large group mainly engaged in electrical-goods manufacture. — One company operates two plants, the principal one at Adelaide and another at Perth, and specialises in making all types of water meters. — A Victorian State instrumentality responsible for water supply and sewerage of the metropolis of Melbourne makes water meters. — Of the three associated companies, one is located in Melbourne (and also makes gas meters) and two in Sydney; one of these specialises in the manufacture of meters for measuring all types of fluids. — One company, in Sydney, also makes petrol pumps, car hoists, lawnmowers.

WEIGHING PLANT (other than Shop Scales)

There are about fifteen manufacturers of weighing machines and apparatus, including weigh-bridges, platform, counting, counter, floor and other types of scales. Two companies are pre-dominant and are associated with well-known overseas organisations. One of these mainly assembles imported components. Some small establishments, in addition to the above, are mainly engaged in repair work, rebuilding, etc.

EQUIPMENT NOT ELSEWHERE INCLUDED, PARTICULARLY FOR PROFESSIONAL, TECHNICAL, SOCIAL, DOMESTIC AND PERSONAL USE

This section sets out the principal types of equipment made in Australia for professional, technical, social, domestic and personal use, not elsewhere included in this study. The approximate number of manufacturers for each type of equipment is shown, and information provided where appropriate of other products or significant associations of a manufacturer. The types of equipment are—

- Clocks and Watches
- Domestic Equipment, Not Elsewhere Included
- Gardening and Curators' Equipment Not Elsewhere Included
- Goldware, Silverware and Jewellery
- Musical Instruments
- Ophthalmic Goods and Optical Equipment
- Ordnance, Arms and Ammunition
- Pens, Pencils, Chalks, Crayons, Schoolroom Equipment (not Furniture), Artists' Equipment
- Photographic Equipment (not Materials)
- Professional and Technical Equipment Not Elsewhere Included
- Sports Requisites
- Toys and Games
- Umbrellas and Walking Sticks

CLOCKS AND WATCHES

Clocks (for domestic, office and factory use, etc., made in quantity): One company, associated with one of the world's largest manufacturers of domestic alarm clocks and electric clocks and of non-jewelled pocket watches, makes utility-type alarm clocks and electric clocks. It is now tooling to make a boudoir-type alarm clock, and hopes, in a few years, to make a non-jewelled pocket watch. — One other company, mainly engaged in electronics and engineering,

makes under a U.S.A. licence, the "Hammond" electric clock movements. Its products include 6½ inch domestic and commercial cabinet and wall clocks, a 6½ inch dial movement and a 12 inch wall-type electric clock. — A few other companies made domestic-type clocks in the early post-war years, but all have now left this field.

Control Clocks, Public Clocks, etc.—Master-and-slave clock systems, frequency-control master-clocks, turret clocks (including striking/chiming), automata, bell ringers, programme clocks and process-timers, etc.: Three companies specialise in making such electrical timekeeping appliances; only one of the three makes automata and similar devices, and this company is also the only maker in Australia of weight-driven water-level gauges, for all periods of operation.

Chronometers: Two manufacturers, both of which make other scientific and technical equipment.

Wristwatch Cases and Bands:

Cases, in precious metals, near-precious alloys, rolled gold and steel (including the forming and fitting of "crystals" of plastics or of glass).

Bands, in precious metals, near-precious alloys, rolled gold, and steel and (usually associated) in silk cords and in leather.

The greater part of Australian output of wristwatch cases is by one of four companies which are engaged in quantity production of that item; the company is also a major manufacturer of metal, cord, leather and fabric watchbands. There are three other makers of metal bands, including a manufacturing jeweller with an associate case-making company. (There are also two specialist makers of leather watchbands and makers of plastic watchbands.)

Casing of Wristwatches: Almost entirely carried out by the manufacturers of cases. (All wristwatch movements are imported.)

Casing of Clock Movements: There are several assemblers, casing imported clock movements (mainly 8-day striking type) in wooden or plastics cases made in Australia.

Watch and Clock Repairing: There are about 100 establishments large enough to be classified as factories. Watch repair is also carried on to a substantial extent by skilled persons as a spare-time occupation, usually on behalf of a retail jeweller or of another watch repairer.

DOMESTIC EQUIPMENT NOT ELSEWHERE INCLUDED

Cooking, Heating and Washing Equipment:

Domestic stoves, ovens, ranges (not hotel, restaurant or commercial types), stovettes, and grillers fuelled by gas, electricity, solid or liquid fuels.

Domestic water-heating and storage units, including bath and sink heaters, fuelled by gas, electricity, solid or liquid fuels.

Space heaters (convection heaters):

Kerosene heaters.

Clothes-washing machines, dish-washing machines, washing-boilers.

Within this broad group of activities are about 170 firms whose activities embrace production of one or more of the products shown at the left. There are about ten major firms engaged in making both commercial and domestic stoves, ovens, ranges, etc., some as their main production, but with others the activity is of lesser importance, while nearly all are also engaged in some other allied production (see "Plant for Some Specific Industrial Activities", earlier this chapter, for commercial cooking and baking appliances, and Chapter 9 for ferrous foundries). — In addition to the above there are about fifty smaller firms, which are mainly engaged in production of domestic types of stoves, ovens, stovettes, grillers, etc., is closely linked and sometimes fully integrated with the ferrous-foundry industry and sometimes with the vitreous-enamelling industry. — Most of the electric water-heating units are made in the sheetmetal working, coppersmithing, and in hot-water engineering workshops more than in the cooking-appliance industry. — Space heaters (solid fuel) are made by about five firms. — Kerosene heaters are mainly made by about seven firms. — Clothes-washing machines and/or dish-washing machines are mainly made by about seventeen firms. Practically all these manufacturers rely to some degree on other firms outside this group for some components or processing. (See Chapter 11 for electro-mechanical machines.) — Within this group are some companies, essentially maintenance or service engineering shops, which are more concerned with repairing than with manufacture of total domestic units.

grillers, etc. — The production of fuel stoves, washing boilers (solid fuel), etc., is closely linked and sometimes fully integrated with the ferrous-foundry industry and sometimes with the vitreous-enamelling industry. — Most of the electric water-heating units are made in the sheetmetal working, coppersmithing, and in hot-water engineering workshops more than in the cooking-appliance industry. — Space heaters (solid fuel) are made by about five firms. — Kerosene heaters are mainly made by about seven firms. — Clothes-washing machines and/or dish-washing machines are mainly made by about seventeen firms. Practically all these manufacturers rely to some degree on other firms outside this group for some components or processing. (See Chapter 11 for electro-mechanical machines.) — Within this group are some companies, essentially maintenance or service engineering shops, which are more concerned with repairing than with manufacture of total domestic units.

Kitchen Appliances: There are about 150 manufacturers of various kitchen appliances. — Some of these are large factories which make a range of products from simple press work or small castings to complicated mechanical devices. There are also many medium-sized and small factories engaged in this activity. Many of the larger firms are also engaged in production of some other allied products, while some of them are only assemblers, having most of the processing executed by jobbing or service firms.

Non-electric Lamps and Fittings and Repairs, including the manufacture of pressure lamps, petrol or kerosene fired, such as blowlamps, incandescent-mantle lamps (table or lantern types), and wick lamps such as table lamps and hurricane lamps: Five companies make incandescent-mantle pressure kerosene and/or petrol lanterns. — One of these companies makes under agreement to a well-known overseas firm, and also makes table lamps (incandescent-mantle type), pressure stoves, radiators, and laundry irons. — One company also makes table lamps (incandescent-mantle type), pressure laundry irons and radiators. — Of the remaining three companies, one makes a range of products including pressure laundry irons, radiators and stoves; one company makes blowlamps; one company makes pressure stoves. — Three com-

panies mainly engaged in sheetmetal-working make hurricane lanterns, while several companies make kerosene table-lamps; one of these latter companies is Australia's largest manufacturer of glass products.

Wringers and Centrifugal Driers are mainly produced by about twenty firms whose main activities are those of general engineering. Much of the component parts are produced by other firms outside this group.

Rotary Clothes-lines (including hydraulic type): About thirty manufacturers, of which about ten are also engaged in preparing and erecting metal and wire fencing. One of them is also a prominent manufacturer of ladders.

Pots, Pans, and Similar Kitchen Utensils are spun, drawn and cast, depending upon the production, by about thirty firms—see "Sheetmetal Working", later this chapter.

Cutlery: See "Plant of a General Nature", this chapter.

Electroplated ware: See "Sheetmetal Working", this chapter.

GARDENING AND CURATORS' EQUIPMENT NOT ELSEWHERE INCLUDED

Lawnmowers: Ten manufacturers make manual-type, six make petrol engine-powered, three make tractor-drawn type, and seven make electric-powered type. One of these manufacturers makes three different types and various-sized models within each type, and four others make two different types and various-sized models within those types. One of the companies is associated with a leading United Kingdom manufacturer of mowers, and at least five of the manufacturers are also actively engaged in other manufacture.

Spray Equipment, Irrigation: See "Agricultural and Pastoral Plant".

Spray Equipment, Insecticidal, Manual Operated: About thirty-five manufacturers, all of which make a range of spraying equipment.

Sprays, Knapsack: About ten manufacturers.

Spray Outfits, Power-operated: Five manufacturers.

Rollers: About fifteen manufacturers, three of which are large-scale concrete pipe makers and two of which are mainly ironfounders.

Wheelbarrows, Metal: Twenty-five manufacturers, all of which are engaged in other activities.

Wheelbarrows, Wooden: Four manufacturers.

Spades, Forks, Hoes, Rakes, Clippers, etc.: See "Handtools".

Hoses: See "Rubber Products", Chapter 8; and "Plastics Products", Chapter 7.

GOLDWARE, SILVERWARE, JEWELLERY

Fine Ware and Jewellery

CUTTING AND POLISHING OF PRECIOUS AND SEMI-PRECIOUS GEMS: About ten establishments, of which three are the principal lapidaries in Australia.

GOLDSMITHS, SILVERSMITHS AND JEWELLERS CONCERNED MAINLY WITH MANUFACTURE OF FINE WARE AND REAL JEWELLERY, MADE BY CRAFTSMAN LABOUR: About thirty establishments, mainly located in the capital cities. This is a well-defined group, with little inter-activity with the manufacturing-jeweller group. Certain jewellers specialise, such as in diamond-set articles, particularly diamond rings in quantity. (For "Platinum-ware Manufacture", see Chapter 9.)

MANUFACTURING JEWELLERS CONCERNED WITH QUANTITY PRODUCTION, MAINLY IN 9-CT. GOLD AND IN SILVER, of articles such as personal jewellery, men's accessories, and where "jewelling" is required using cameos, opals, semi-precious and synthetic gem stones, marcasite, stones and beads of glass including imitation pearl: About 180 manufacturers, seven of which operate large establishments. Some manufacturing jewellers are trade suppliers of jewellers' accessories and findings. Others make also the better-quality non-precious costume and stage jewellery.

CHAIN MAKING (machine made), in gold, silver, 9-ct. rolled gold, gilding metal and brass, for manufacturing jewellers: Trace and curbed chain is principally made by one company, which also makes chain accessories—jump rings, safety-pins, barrel-snaps, etc., and draws wire for own requirements and for sale; the company is an associate of a leading manufacturing jeweller. Another manufacturer, recently established, is the only manufacturer in Australia of snake chain (also called "Brazilian" chain), which are made in various shapes; the manufacturer also makes curbed and trace chains. The largest manufacturer in Australia of watch-cases also makes trace and curbed chains for own requirements (such as wristwatch "straps"), and is tooling to make snake chain. (See also "Chains", later this Part.)

Imitation Jewellery

IMITATION JEWELLERY AND DRESS ORNAMENTS AND ACCESSORIES in non-precious metals and using semi-precious stones, beads, glass, cultured pearls, baroque pearls, diamante, and marcasite: Several manufacturers, of which two or three make high-grade brand-name products. Some of the larger companies make a range of selective jewellery and one is also a manufacturer of plated ware, cutlery and similar products. A small number of firms make "catches", "clasps", brooch-backs and ear-ring-backs and other jewellery findings, principally for wholesaling to other manufacturers and jewellery repair establishments.

COATING AND MAKING-UP OF IMITATION PEARL JEWELLERY is the activity of one company only, which imports its own beads and fish-silver. (Making-up of imitation pearl jewellery is also carried on by other makers of imitation jewellery, but most imitation pearl jewellery sold in Australia is imported in made-up condition.)

There are a small number of "setters" of imitation jewellery.

MUSICAL INSTRUMENTS

Pianos, Player-Pianos, Organs: Making and/or reconditioning of pianos and player-pianos: About forty establishments, the majority of which repair and recondition pianos and organs, etc. — One company employs over 200 persons, has its own foundry, and imports the piano movements and manufactures cabinets, stands, etc., and assembles. — One smaller company, not possessing a foundry, is similarly engaged (it also makes cabinets for organs, wireless sets and sewing machines). — One company, chiefly engaged in making of amplifiers, public-address systems, etc., makes electric organs (cabinets for which are made by the company mentioned above). — Several small firms recondition and repair organs and pianos.

Violins, Violas, Cellos: About nine makers in Australia, all of which are small specialised craftsman workshops. Only two of them make bows, but most carry out repairs to bows. Most timber for violin making is imported from Europe. Two of the above firms make stringed-instruments strings and bow rosin. There is only one manufacturer of fibre-board violin and such like cases, while a few others make wooden instrument cases. Australian-produced gum rosin and glue are used, some Australian-prepared horsehair for bows, and usually own-prepared varnishes are also used by the makers. Only an occasional double bass is made in Australia.

Other Musical Instruments—Guitars (Spanish, Hawaiian, electric), banjo-mandolins, ukeleles, drums and drum sets and accessories, tonettes: About fifteen establishments are engaged in making various types of instruments.

Gramophones: There is one company in Australia owned by a U.K. parent company, Electrical & Musical Industries Ltd., which is foremost in Australia in the manufacture of gramophones, radiograms, electrograms and records. E.M.I. (Aust.) Pty. Ltd. makes a large range of electrical products, acoustic gramophones, electrograms, radiograms, steel and sapphire-pointed needles, pick-up units, matrices and records. Its records are sold in Australia under "His Master's Voice", "Columbia", "Parlophone", "Decca", "Regal Zonophone" and "M.G.M." trade names. Two subsidiaries distribute the products throughout Australia, and a third company, recently registered, will ultimately make television equipment.

Acoustical Gramophones: Only two companies make acoustical gramophones. One is mentioned above; the other is a much smaller company.

Electrograms: There is only one manufacturer of electrograms in Australia. For details see Chapter 11, "Electrical and Electronic Products".

Radiograms: There are about thirty-five manufacturers of radiograms in Australia. For details see Chapter 11, "Electrical and Electronic Products".

Recording and Play-back Equipment: About five companies make recording and play-back equipment for commercial purposes, while a sixth makes only home-use recording and play-back units.

Tape Recorders and Wire Recorders: See Chapter 11, "Electrical and Electronic Products".

"Juke" Boxes: One manufacturer.

Gramophone Records (78 r.p.m.): One company, Amalgamated Wireless (Australasia) Ltd., working under a United Kingdom licence, makes master discs and also matrices. Four other companies also produce matrices (but not master discs), and from the matrix produce record discs. A number of broadcasting stations cut master discs, from which the matrices and record discs are made by any of the five companies mentioned above. (It is expected that "microgroove" records will be made in Australia towards the end of 1952.)

Player-Piano Rolls: Two companies make player-piano rolls in Australia.

OPHTHALMIC GOODS AND OPTICAL EQUIPMENT

Eye Testing and Measuring Equipment, including optical gauges and lens measures, coordinascopes, hydraulic and non-hydraulic chairs, test charts, floor stands, mirrors, instrument

tables, adjustable stools, edging machines, bevelling machines, bench accessories, surfacing machines, ophthalmic handtools: One major manufacturer with interstate and provincial branches has three factories in Melbourne, three in Sydney, and also a branch in Colombo, Ceylon. A few other companies make a limited range of such equipment.

Spectacles:

Lenses—single, bi-focal, multi-vision

Spectacle making—grinding, polishing and/or mounting of lenses to individual prescriptions

Spectacle frames—Xylonite or imitation steel, moulded plastic, metal, rimless mountings

Spectacle parts—hinges, screws, temple wires, etc.

Spectacle cases

Sun goggles, ray-absorbing and other protective goggles and shields

Artificial eyes

One major company predominates in this field (see also above). A small number of manufacturing firms, and also a relatively large number of opticians in professional practice, are engaged in lens grinding, polishing and mounting.

Optical equipment, including microscopes, telescopes, colorimeters, spectrometers, spectroscopes, spectrographs, microtomes, polarimeters, etc.: There are about three major manufacturers, and a few other companies which make items of optical equipment to specifications.

ORDNANCE, ARMS AND AMMUNITION

The Armed Services requirements are made at Commonwealth Government Ordnance, Small Arms and Ammunition Factories specifically operated for that purpose. (Throughout the 1939-45 War, certain types of field artillery, sub-machineguns, the forgings of shell-bodies and rifle furniture were made by non-Government establishments.) — The Commonwealth Government Small Arms Factory at Lithgow, N.S.W., is making .22 sporting rifles, single-shot and repeater, to the order of a sporting requisites manufacturing company, and is also making single-barrelled .410 shot guns by converting .303 military rifles. — One other company makes .22 single shot and repeating sporting rifles. — A few smaller establishments, concerned mainly with retailing and with gun repairs, also make rifle and gun parts and accessories; one or two make up guns and rifles from bought-in parts. — All sporting ammunition—.22 rifle, short and long, and 12-gauge shot-gun of various types—made in Australia is made by one company only (see also "Explosives", Chapter 6). — Filling of imported 12-gauge shot-gun shells with imported and Australian-made components is being done by some other suppliers, to a limited extent only.

PENS, PENCILS, CHALKS, CRAYONS, SCHOOLROOM EQUIPMENT (NOT FURNITURE), ARTISTS' EQUIPMENT

Pens: There are three manufacturers of ballpoint pens and six manufacturers of fountain-pens (two of the latter are plastics-moulding companies). — One company makes steel nibs. — Pen handles and nib holders are made by several small companies.

Pencils: Five companies make wood-encased lead-pencils; one also makes wood-encased crayons (and carbon paper and typewriter ribbons). — About eight manufacturers make propelling pencils (two of these also make fountain pens). — Two companies make etching pencils.

Chalks, Pastels: Three manufacturers in Australia.

Wax Crayons: Several small manufacturers, including one of the chalk and pastels manufacturers.

Slate Pencils: One manufacturer.

Slates and Blackboards (made from hardboard and coated): One manufacturer.

Schoolroom Equipment (rules, set squares, T-squares, etc.): Several manufacturers of schoolroom equipment, usually of wooden or plastic material.

PHOTOGRAPHIC EQUIPMENT (NOT MATERIALS)

Box Cameras: One company makes limited quantities of box cameras, the lenses for which are produced by a specialist lens-grinding company in Tasmania.

X-Ray Cameras and Photographic Equipment: About four major manufacturers—see "Diagnostic Equipment", this section.

Darkroom Cameras for Newspaper Work: One specialist manufacturer, associated with the printing industry.

"Photo-finish" Cameras for horse racing and other sporting activities are generally made to order by a few specialist companies. Several units have been exported.

Photographic Accessories, including enlargers, drying equipment, camera stands, tripods, dishes,

and developing appliances, lamps and lamp stands: About 20 manufacturers make a range of photographic accessories either as a specialist activity or in association with general jobbing or repetition engineering.

Film Projectors: Three companies make 16-mm. film projectors (one of these companies also makes automotive spark plugs, tape and wire recorders, fuel-injection equipment, and gas hot-water heaters). — One company, a branch of a leading U.S.A. projection-equipment company, has had 35-mm. sound projectors made for it in Australia by a Commonwealth Government small-arms establishment.

Strip Projectors: Two companies, also making lenses, pantographs and miscellaneous scientific equipment.

(The manufacture of cameras, parts and accessories is grouped in official statistics with the manufacture of films, plates, etc., and developing and printing. See Chapter 5 for photographic materials, and developing and printing services.)

PROFESSIONAL AND TECHNICAL EQUIPMENT NOT ELSEWHERE INCLUDED MEDICAL, SURGICAL, DENTAL, AND ALLIED EQUIPMENT

Diagnostic Equipment

ELECTROCARDIOGRAPHS, ELECTROENCEPHALOGRAPHS, RAY THERAPY EQUIPMENT: Four companies make X-ray equipment. The leading company, which is affiliated with leading overseas X-ray manufacturers, makes a wide range of X-ray equipment and accessories and it has an associated manufacturing company and factories in both Sydney and Melbourne. One other of the four companies makes an extensive range of X-ray apparatus; one of the others makes a limited range of X-ray therapy equipment but does not make deep X-ray units. The remaining company, a world-wide electronics manufacturing company, makes X-ray equipment for dental purposes and expects to produce, towards the end of 1952, mobile X-ray units for diagnostic purposes. (X-ray tubes are not made in Australia.)

SPHYGMOMANOMETERS, BRONCHOSCOPES, LARYNGOSCOPES: Two companies, both of which make a range of other medical and surgical instruments.

Surgical Equipment

ELECTRO-SURGICAL EQUIPMENT: The largest X-ray equipment manufacturer is the only producer in Australia.

SURGICAL INSTRUMENTS, including bone gougers, bone mallets, curettes, gags, retractors, scalpels, all nose and throat instruments, bowel holders; forceps including artery, dressing, sinus, mosquito, Cheatles steriliser, biopsy specimen and others: Two major and one smaller manufacturers.

HYPODERMIC SYRINGES: Four manufacturers, two of which make hypodermic needles.

ANAESTHETIC APPARATUS, including various types of ether apparatus with attachments: Three manufacturers, all of which make a range of units and which make other items of surgical and medical equipment.

OPERATING-THEATRE EQUIPMENT, including operating tables and portable orthopaedic tables; vacuum pumps and blowing units; drainage pumps; centrifuges; automatic breast pumps; etc.: Eight manufacturers, two of which make a range of laboratory equipment. One company makes most of the medical type vacuum and suction pumps.

Medical Laboratory Equipment (not glassware) including autoclaves, sterilizers, incubators, diabetic and baby's scales, plaster shears, bunsen burners (with and without attachments), spirit burners, retort clamps, bases and rods, hot air ovens and water ovens, laboratory wood-ware, analytical weights, metric weights, anaerobic apparatus: About seven major manufacturers make a range of laboratory equipment; many firms make items of this equipment in association with other activities. (See also "Scientific and Technical Laboratory Equipment", later this Part.)

Artificial Limbs: Seven manufacturers, of which one is owned by the Commonwealth Government. Trusses and belts are made by about 10 manufacturers most of which are engaged in other manufacturing.

Dental Equipment

DENTAL UNITS: Three manufacturers, one of which does not make or instal electric motors in its units.

DENTAL FOOT-ENGINES: Two manufacturers.

DENTAL MOULDS: Two manufacturers.

DENTAL INSTRUMENTS: Two manufacturers, one of which makes a large range while the other makes a limited range.

ARTIFICIAL TEETH: Two major manufacturers and a few minor manufacturers.

DENTAL X-RAY UNITS: See "Diagnostic Equipment", earlier this section.

HEAD-RESTS, PRESSES, SPITTOONS, SWINGERS, SYRINGES, TRAYS, VULCANIZERS: Two manufacturers, both of which make most of the items specified above.

Veterinary Instruments, including hypodermic syringes, drenching guns and cattle syringes, trocar and canular bull rings, bull ring nose punches, bull leads, caponising sets, dehorner, ear-label pliers, tattoo ear-markers, emasculators, horse-mouth gags, horse-tooth rasps, lamb clams and knives, milk-fever outfits, milking tubes, teat dilators, speying scissors, etc.: One manufacturer makes a wide range of such items. Two specialise in hypodermic syringes and other injection instruments; one makes cattle dehorner and douching guns (but its main activity is making aeroplane components). A small number of other manufacturers make specialised items and components for veterinary instruments.

Laboratory Equipment

MEASURING AND RECORDING INSTRUMENTS, including thermometers, barometers, barographs, chronographs, tachographs, tachoscopes, pyrometers, meteorological instruments, hydrometers, etc., are made by about four major manufacturers which each make other laboratory equipment.

OVENS, FURNACES AND OTHER HEATING EQUIPMENT: About three manufacturers.

CENTRIFUGES, AUTOCLAVES, ETC.: About three manufacturers.

Scientific and Technical Field Equipment, including surveying and navigating equipment: Four manufacturers, one of which makes a wide range of such equipment and other recording and metering instruments.

Calculating Equipment: About fifteen manufacturers, most of which are engaged in other engineering activities.

Draughtsman's Equipment—slide rules, protractors, set-squares, compasses, mathematical drawing-sets, parallel rules: About eight manufacturers make mathematical drawing-sets; one major manufacturer makes a range of scales, protractors, set-squares, slide-rules, etc., and one other major manufacturer makes compasses and other equipment. One other company produces school quadrant compasses, drawing-office equipment, and also makes a wide range of other technical and commercial engineered products.

SPORTS REQUISITES AND EQUIPMENT

There are four major establishments solely engaged in making sports requisites. A number of other firms make sporting equipment, but most of them have as their major activity the production of leather, rubber or canvas goods, woodturning, or general engineering, and make sports requisites as an associated activity. The main items of equipment made are as follows—

Sports Requisites:

Tennis (etc.) equipment—racquets, balls, nets, racquet presses, trainers, leather grips, squash-frames and presses

Golf equipment—clubs, club heads and shafts; balls, tees; bags, golf bag buggies, leather grips

Badminton—frames, presses, shuttles

Cricket—bats, balls, stumps, pads, gloves, matting and nets

Baseball and softball equipment—bats, balls, gloves, mitts and guards

Fishing equipment—reels, rods, swivels, floats, sinkers, lines, landing-nets, etc.

Other sporting equipment—balls, (footballs, basket balls, soccer balls, etc.); hockey sticks; bowling equipment; boxing gloves; skates (roller and ice); skis; table tennis tables

Four important companies make or have made for them a wide range of all types of sporting requisites. Several smaller firms specialise in making sporting equipment of a specific type. (See Chapter 14, "Leather and Leather Products", and Chapter 8, "Rubber Products", for comments on sporting-requisites manufacture.) About six companies make sports nets, mainly tennis nets, usually with other activities (see Chapter 17 for comment on netting manufacture). One of the large companies has sporting rifles

made for it by the Commonwealth Government Small Arms Factory, Lithgow, N.S.W.

Playground Equipment: About 15 manufacturers, mainly concerned with tubular-steel fabrication or engineering.

Totalisators: One large company makes stationary and mobile totalisators, and supplies totalisator activities, including precision engineering, project engineering, diecasting, and manufacture of plastics-moulding dies, press tools, gauges, etc.

Horse-racing and Dog-racing Barriers and Starting Stalls: A few specialist manufacturers.

TOYS AND GAMES

Soft Toys—of felt, lambskin, fur or fabric. There are several makers of toy animals and dolls. Some of these manufacturers are associated with skin and fur dressing and dyeing while others are essentially toy makers.

Dolls of rubber, composition, plastics or fabric: There are about 20 manufacturers of which a few are medium sized and the balance are small establishments. A few companies make dolls' limbs and dolls' clothes. Practically all dolls' eyes are imported.

Metal Toys—scooters, tricycles, pedal cars, clockwork toys, pressed-metal toys, electric and clockwork trains, toy construction sets, diecast metal toys: One large company makes a large range of wheeled metal toys. Most other companies making metal toys also make other metal products.

Plastics Toys, all types: Mostly associated with the manufacture of other plastics products. Several moulders pay special attention to the production of toys.

Wooden Toys: Mostly made by woodworking establishments specialising in wooden toys.

Rubber Toys: Mostly an activity of the rubber industry (see Chapter 8).

Toy Prams and Perambulators: A few specialists, but the main activity exists as part of the pram-making industry.

Games—boards, pieces and cards: The bulk of the board games are made by one company, stationery manufacturing and general printing, which has Commonwealth-wide distribution. A few other companies make pieces and other accessories for board games. — Four companies make playing cards; all of these are associated with the printing industry.

UMBRELLAS AND WALKING STICKS

Umbrellas

STREET, PARASOL, SUNSHADE TYPES: Two major manufacturers, one with branches in N.S.W. and Victoria, make a wide range, including beach, bookmakers' and garden types. The frames are assembled from imported stays, ribs, etc. — There are several smaller manufacturers, including wholesale umbrella establishments.

BEACH, BOOKMAKERS', GARDEN: Inter-related with the manufacture of canvas goods, folding furniture, etc. There are three major manufacturers, one with branches in all States. One company, a major manufacturer of folding furniture, makes all its own ribs, stays, etc., from Australian-made high-carbon spring wire.

Walking Sticks: Made by several manufacturers, mainly engaged in woodturning, wood products or umbrella manufacture.

SHEETMETAL WORKING, FINISHING (COATING, POLISHING, etc.), WIRE WORKING, SCREWS, BOLTS AND NUTS, CHAIN

SHEETMETAL WORKING, AND ASSOCIATED FINISHING

In addition to the establishments classified as sheetmetal-working factories, some of which undertake coppersmithing as a regular but lesser activity, there are about fifty establishments mainly or wholly engaged in **coppersmithing**. In official statistics, the activity is included with non-ferrous foundries and brass-finishing establishments, but in this study, for convenience, the activity of coppersmithing is grouped with sheetmetal-working generally.

The establishments classified in 1949-50 official statistics as being wholly or mainly engaged in sheetmetal working, pressing and stamping were responsible in that year for the production of over 90 per cent. (by quantity) of wireless chassis; about 60 per cent. of kitchenware; about 60 per cent. of boxes and trunks; 11 per cent. of office equipment and metal furniture; over 70 per cent. of petrol tanks; about one-third (by quantity) of wheelbarrows; a small proportion of enamelled baths; about 55 per cent. (by quantity) of stainless-steel sinks; one quarter (by quantity) of electric bath-heaters; two-thirds (by quantity) of gas bath-heaters; about one-tenth (by quantity) of cooking stoves; one sixth (by quantity) of washing machines; and a proportion of refrigerators. It was also responsible for the production of about 18 per cent. (in value) of air-conditioning machinery; about 4 per cent. (in value) of dairy and butter-making, metalworking and pumping machinery. Many large engineering companies proper possess their own sheetmetal-working sections, and these are not necessarily included here. An outline of circumstances of production of various sheetmetal items is set out below (but see elsewhere for electric and electro-mechanical appliances, and stoves, ovens and ranges)—

General Activities

Tinsmithing (guttering, downpipe, etc.): Numerous firms ranging from "one-man shows" to those employing large numbers of persons carry out tinsmithing in all cities and towns of any size. Many of these also make tanks of all types, troughs, guttering, downpipe and similar sheetmetal products. Several of the larger sheetmetal-working establishments also make guttering, downpipe, etc., as a part of their general activities.

Coppersmithing (stamping, pressing, brazing, etc., of copper sheet, tube, rod, etc.), including copper boilers, coils, cylinders, floats, ball valves, frames, funnels, gaskets, hollow-ware, pans and calorifiers, pipes, stills and tanks, urns, vacuum pans, etc.: There are about fifty manufacturers wholly or mainly engaged in making individual items or a wide range of copper products. (These establishments, for statistical purposes, are classified with non-ferrous foundries and brass-finishing establishments.) In addition, several establishments, usually classified for statistical purposes as sheetmetal workers, are also engaged in coppersmithing as part of their general activities.

Stainless-steel Products: There are numerous firms established in all capital cities of the Commonwealth making a wide range of stainless-steel products and equipment for hospitals, hotels, cafes, and for the chemical and other industries where stainless-steel equipment is required. Included in this group are twenty firms which make stainless-steel sinks; most of these firms also make other stainless-steel equipment.

Deep Drawing of steel, copper, brass and aluminium sheet is carried out extensively throughout the Commonwealth. Most sheetmetal-working establishments have some capacity for deep-drawing, particularly for steel sheet. With small firms this capacity is very limited, but some of the larger firms, including major motor-body building establishments such as Austin Motor Company (Aust.) Ltd., Chrysler Australia Ltd., The Ford Manufacturing Co. Pty. Ltd. and General Motors-Holdens Ltd., have considerable capacity. Practically all the panels for motor-vehicle bodies pressed in Australia are pressed by the companies named above, two of which also press refrigerator panels. Stainless-steel sinks, certain dairy utensils and other large deep-drawn products are made by the other firms with large presses. — Most of the deep-drawing of aluminium is for the manufacture of kitchen utensils. There are several firms engaged in the production of these items by deep-drawing, usually in association with other sheetmetal-working activity. — The deepest precision deep-drawing is done with non-ferrous metals, particularly rolled brass, and is carried out by at least ten firms. One, making metallic bellows, has capacity to draw tube in varying wall thicknesses from 3.5 to 5 thousandths of an inch with a margin of error of plus or minus $\frac{1}{4}$ thousandth and in varying diameters up to 2 inches to a depth of 24 inches; this firm also draws tube to a depth of 12 inches with diameters ranging from $\frac{7}{16}$ inches to $2\frac{1}{2}$ inches. — The other nine firms have capacity to draw to depths of from 12 to 18 inches in varying diameters up to $2\frac{1}{2}$ and 3 inches. Two of these firms (one of which is closely associated with an American organisation) make eyelets. — Five firms (including the two above) make cosmetic containers. — Three other firms are major manufacturers of plated ware and aluminium kitchen utensils (one of these operates a non-ferrous foundry and is a major manufacturer of medallions, trophy crests, etc.), while a fourth is actively engaged in a wide range of sheetmetal products.

(Impact Extrusion: The manufacture of collapsible tubes and metallic capsules is referred to in "Lead", Chapter 9; impact extrusion of zinc and of aluminium are included with the processing of those metals in Chapter 9.)

Jobbing Metal Pressing and Stamping: Numerous firms, usually established in the capital and major cities and towns, do metal pressings and stampings on a general jobbing basis.

Perforated Metal—plate or sheet of copper, brass, stainless steel, etc., having holes of various sizes and shapes in a variety of combinations and spacings: One manufacturer in Victoria predominates, making a wide range of perforated metal sheet and also specialising in the manufacture of fans and blowers. One other company in N.S.W. makes a relatively small range, and several firms make perforated sheet and plate for use within their own organisations.

Finishing Activities: Many manufacturers in sheetmetal-working activities do their own finishing operations, and some also do such work for sheetmetal-working firms without, or with insufficient, capacity for finishing operations such as galvanising, tinning, electroplating and polishing, vitreous-enamelling, stove-enamelling and paint finishes otherwise. An indication of trade-finishing services is as follows—

GALVANISING and TINNING: Galvanising is usually done by the manufacturers of galvanised products, there being about 400 such establishments in Australia. About twenty-seven of these engage regularly in galvanising as a jobbing activity. Similarly, approximately seventeen metal-working firms do tinning for outside clients.

ELECTROPLATING and POLISHING: There are more than 300 establishments wholly or mainly engaged in trade electroplating and polishing. The greater number are concerned with nickel and chrome plating, and occasionally cadmium; a few are concerned only with silver and gold plating. Many establishments work in close association with sheetmetal-working companies, diecasters, etc., sometimes in the same or an adjacent building, giving a preferred service and utilising excess capacity for whatever other trade electroplating, etc., can be secured. Some electroplaters import unplated flatware, particularly forks and spoons, on their own behalf, to plate and polish for disposal to warehouses, etc.

VITREOUS ENAMELLING: There are about twenty-three establishments in Australia which carry out vitreous enamelling. One company, a major manufacturer of stoves and hollow-ware, operates the largest vitreous-enamelling plants in Australia, at four establishments in each of four States, New South Wales, Victoria, South Australia and Western Australia, and does vitreous enamelling for its own products and a small amount of jobbing. This company also makes some of its own frit requirements. — Five manufacturers of stoves also operate their own vitreous-enamelling plants and all do some general jobbing. One of these companies operates a continuous-type furnace, and one other makes some of their own frit re-

quirements. — Three manufacturers of refrigerators, all of which are large manufacturers of refrigerators, operate plants for their own needs. — Two manufacturers of neon and other types of signs operate their own plants and do general jobbing work. — Two manufacturers of baths and basins, one in cast iron and the other in sheet metal, operate their own plants and do general jobbing work. — A major manufacturer of pasteurising plant and a manufacturer of hollow-ware operate plants purely for their own use. — A large sheetmetal-working establishment operates an enamelling plant for its own requirements and does general jobbing work. — Four jobbing enamellers who operate comparatively small plants carry out all types of vitreous enamelling to order. One of these firms is a subsidiary of a major manufacturer and supplier of frit, oxides for colouring, glazes for glassmaking, etc.

STOVE ENAMELLING AND PAINT FINISHING: The rapid advancement of industrialisation coupled with revolutionary changes in paint technology has given rise to firms which engage in special finishing for outside manufacturers. This includes stove enamelling of refrigerator parts, crackle finishes on electrical equipment, the lining of drums, and rust-proofing treatment, for organisations which lack facilities for doing such work within their own premises. In addition to the many manufacturers who operate their own stove enamelling and special paint-finishing services there are many firms in each State operating as specialists and providing a trade service in these fields, some finishing and packing products to retail selling condition for the manufacturer or originator.

Some Specific Categories of Products

Baths, Basins (sheetmetal): There are several sheetmetal-working establishments which make galvanised sheetmetal baths for domestic use. One company makes a pressed metal, enamelled bath and operates a vitreous enamel plant for its own use and for general jobbing work.

Builders' Hardware (sheetmetal): See "Builder's Hardware", this chapter.

Packers' Cans, General Line Cans (Fancy, Hinge-lid, Slip-cover, Lever-lid, Oil), Composite Containers: About twenty manufacturers, operating thirty-one establishments, make a range of cans of various types. Cans made include: Packers' cans, i.e., open-top cans made on high-speed machinery and used only for packing processed foods such as jams, preserved fruit and vegetables, meats, etc.; general line cans, which include all other types of all-metal cans, the principal types of which are fancy cans for cosmetics, confectionery, etc., hinge-lid cans e.g., for tobacco, slip-cover cans, e.g., for boot polish, lever-lid cans for paint and similar items, and oil cans which have screw necks and caps; and composite containers, made of cardboard with metal ends and used for example in food packaging (cocoa, salt, etc.) and paint packing; both the spiral and laminated cardboard containers are made, the latter by only a few firms. — Two major companies make about 60 per cent. of total Australian requirements. One of these has five branches, in four States, and makes a wide range of the above types of cans; and also makes crown seals and canvas goods. One is an amalgamation of several companies, with branches in three States, and is associated with United Kingdom and U.S.A. interests. This group makes all types of containers, including composite containers (fibreboard with metal ends), and also makes metal closures. — There are eighteen other manufacturers—three in Queensland, nine in New South Wales, five in Victoria and one in South Australia. — In addition, there are twenty canning firms which, at thirty-two establishments, make some, if not all, of their own can requirements. Of these companies, four operate more than one canning establishment in more than one State. — All major can makers do their own tinplate printing.

Domestic Tinware—Billies, Canister Setc, etc.: Numerous manufacturers throughout the Commonwealth. Some of the above group inter-relate this activity with the manufacture of cans. Two important makers of a range of domestic tinware do not make packers' cans.

In addition to the above users of tinplate there are many users of terneplate and black iron who produce various cans, drums, etc., for products other than food and allied lines (see under "Drums") and who also make various kitchen utensils.

Dairy Utensils—Buckets, Milk and Cream Cans, Milk Vats: Nine major manufacturers. Four companies manufacture as a major activity. — Three companies make a wide range of other sheetmetal products. — Two companies also make stoves (electric, gas and fuel) and other metal products.

Drums and Beer-transport Containers: One major company, joint company of The B.H.P. Co. Ltd. and an American company, with five factories, makes a wide range of drums, including stainless-steel beer-transport containers of cylindrical shape (and underground petrol-storage tanks and domestic storage hot-water services). — The only other manufacturer of beer-transport containers of stainless steel is a company associated with American interests in production of containers of barrel shape, and also making other stainless-steel sheetmetal products; this company is associated with a company making electroplated or polished nickel-silver ware from the raw-metal stage. — About ten smaller companies, including an associate company of the major manufacturer mentioned above, make drums, pails, etc.; two of these are included in previous sheetmetal-working activities.

Electroplated and Nickel-silver Ware Manufacture (stamping, spinning, drawing, casting, embellishing, plating, polishing, etc.), including jewellers' ware, hotel ware, trophy ware, and flatware such as spoons and forks: About forty manufacturers are wholly or mainly engaged in one or more of the preparatory processes and carry out plating and polishing in conjunction. — Only a few of these manufacturers make table flatware. One in particular, a company making plated hollow-ware and flatware and polished nickel-silver ware from the raw-metal stage, has

its own foundry and rolling mill (and also makes stainless-steel products including sinks and, through an associated company, beer-barrels and other containers). — One large plated-ware manufacturer is also a large manufacturer of kitchen hollow-ware and kitchen devices.

Kitchen Utensils. including saucepans, kettles, stewpans, boilers, kitchen tidies, roasters, egg slicers, baking dishes, etc.: There are at least thirty firms, mostly general sheetmetal-working establishments, making various types of kitchen utensils. These firms are small to medium in size and few are specialists. Some operate their own plating and/or enamelling plant.

Medals, Medallions, Trophy-crests, including Vitreous Enamelled: There are about twenty manufacturers, some of which are wholly or mainly engaged in these activities, some of which are also plated-ware manufacturers, and some of which are also diesinkers and engravers.

Metal Tiles, Ceilings, Dadoes, etc.: There are three major manufacturers. One company is one of the largest Australian manufacturers of terra-cotta wall and roofing tiles, also making asbestos-cement products, bricks, stoneware pipes and fittings and similar clay products, and a range of metal products including stainless steel sinks, doors and doorframes, kitchen cabinet units, etc. This company operates some sixteen manufacturing establishments, in five States—Queensland, New South Wales, Victoria, South Australia, and Tasmania—and has an associate manufacturing company in Perth, W.A. Only three of these establishments (one each at Brisbane, Sydney and Melbourne), however, make metal tiles and ceilings, etc.

Metal Closures

CROWN SEALS: There are five major makers of crown seals. One company, with branches in three States, makes about two-thirds of Australia's total requirements. — One company also makes packing cans of various types and canvas goods. — One company is a subsidiary company of a major manufacturer of packing cans of various types. — One company makes a range of sheetmetal products including stoves, washing machines, etc. — These companies also make crown-seal type pickle-bottle tops.

OTHER METAL CLOSURES—pickle-bottle tops, screw caps, preserving-jar tops, etc.: Metal closures of all types are made by the major manufacturers of packing cans (see above). An important manufacturer of metal closures, particularly for glass containers, is a subsidiary of the principal glass-products manufacturer. — Pickle-bottle tops of the crown-seal type are made by the crown-seal makers. — Phoenix-type pickle-bottle tops are made by a subsidiary of a large company making packing cans (and crown seals); by a major manufacturer of sauces, pickles, and preserves, which makes some of its own requirements; and by a subsidiary of the largest glass-products manufacturer in Australia. — Two companies make preserving-jar tops for jars distributed by them; one is a major manufacturer of glass products; the other is a major producer of sauces, pickles, preserves, etc.

METALLIC CAPSULES: There are three manufacturers of metallic capsules, one of which is associated with a United Kingdom organisation. (See also "Lead", Chapter 9.)

Metal Trunks and Boxes: There are about ten manufacturers, all of which make trunks, tin boxes, etc., as a small part of their activities.

WIRE WORKING

Steel wire is made for sale in Australia by three companies only—Rylands Bros. (Aust.) Pty. Ltd., Lysaght Bros. & Co. Pty. Ltd., and West Australian Netting and Wire Co. Ltd. The first two companies are subsidiary companies of The Broken Hill Proprietary Co. Ltd., the only manufacturer in Australia of wire-rod feed for wiremaking mills. A few other companies draw steel wire for their own use. (See "Wiremaking, of Steel", Chapter 9.) The manufacture of products from steel wire (excluding screws, bolts, nuts, chain—see later this Part) is carried on by about 200 establishments, including those of the three companies also making wire for sale. Products and manufactures are as follows—

Barbed Wire: Thirteen manufacturers, fifteen establishments. Three manufacturers are the wire-makers named above. — Another manufacturer, The Titan Manufacturing Co. Pty. Ltd., at three establishments, one in Victoria, two in Tasmania, is a subsidiary company of The B.H.P. Co. Ltd., and makes barbed wire, wall ties, staples, nails and clouts at its Melbourne, Vic., plant, and barbed wire, nails, wood chisels and auger bits at its Hobart, Tas., plants; all wire and chisel billets are obtained from within the B.H.P. group. — One company at two establishments, one each in Victoria and New South Wales, makes both twisted and welded barbed wire (the only maker of the welded type), and also makes welded and woven wire-fence, and are also nail makers) make barbed wire, each with one establishment, one in N.S.W., four in Victoria, one in Queensland, and two in South Australia (one of the latter principally a cordage works).

Netting: Four manufacturers, each with one establishment. Principal makers are the two B.H.P. wiremaking companies. — The State Penal Department, Victoria, makes netting at its principal prison, and obtains netting wire from the B.H.P. group. — The wiremaking company in Western Australia also makes netting.

Nails, Brads, Clouts, Wall Ties, Staples, Tacks, etc.: The three B.H.P. wire-products companies are large producers of nails, brads, clouts, etc., but do not produce tacks. — One of the largest producers has one establishment in each of three States, Victoria, N.S.W. and Queensland, making a wide variety of steel nails, including roofing nails (of which there are four

makers in Australia), and also copper rivets, boat-nails and roves; the company is the largest manufacturer in Australia of tacks, and also makes metal-thread screws and nuts, wood screws, washers, rivets, round bills, brads, spikes, corrugated wood-fasteners, heel and toe plates. Wire and wire-rod is obtained from the B.H.P. group; the company draws its screw-wire requirements. Tack sheet is obtained from Lysaght's Works Pty. Ltd. (The company is also a leading maker of printing inks and has a printers' machinery and furnishing warehouse.) — Tacks are also made by a major manufacturer of boot and shoe machinery, footwear findings and pins, and by two small makers. — There are fifteen other makers of nails, mainly building and case nails, one a specialist in roofing nails, and seven of which also make barbed wire.

Wire Rope: One manufacturer only, The Australian Wire Rope Co. Pty. Ltd., Newcastle, N.S.W., a subsidiary company of The B.H.P. Co. Ltd. Wire is obtained from the associate company Rylands Bros. (Aust.) Pty. Ltd., Newcastle, N.S.W. Rope is made from $\frac{1}{4}$ in. to 10 in. circumference, of constructions up to six strands of 91 wires, with weights up to 10 tons without splicing, and breaking strains up to 343 tons. The company operates a wire-rope testing house approved by Lloyds Register of Shipping, the only Lloyds testing-house in Australia for wire-rope.

Woven Wire, including Screening Wire (heavy to light duty), Filter Wire, Fly Wire: Eight companies produce woven wire. One company, using both ferrous and non-ferrous wire, and drawing some of its wire requirements from heavy-gauge wire, produces a wide range of woven wires from 1 in. to 120 mesh in all gauges of wire up to $\frac{1}{2}$ in. — One company, operating a branch factory in all States other than Tasmania, makes woven wire in 12, 16 and 18 mesh in gauges 33, 28, 26 and 24, using zincoide and bronze wire. The company also makes fabricated wire-fence of two types, wire conveyor-belts, tubular-steel frames of all types, gates, machinery guards, playground equipment, ornamental wrought-iron work (and through subsidiary companies has investments in manufacture of forgings, tubular-steel scaffolding, and packers' cans). — One company makes $\frac{3}{8}$ in. to 120 mesh, using all types of wire, and also produces a range of wire products. — Five smaller companies make woven wire in association with general wire-working.

Wire Mattresses: "Woven" wire-mattresses of the spiral interlocked type are made by about 45 companies and businesses (most of which also make bedding of filled and inner-spring types). One of the principal companies making wire mattresses and bedding of all types also draws and tins mattress wire for its own products, using Australian and imported heavy-gauge wire.

Wire-fence, Fabricated: About 24 companies (including three mentioned previously in this section) make fabricated wire-fence, mainly of the interlocked type, that is, not welded. In most instances other products such as tubular-framework gates, machinery guards, etc., are made.

Wire-mesh, Welded, for Reinforcement, Wire-fence, etc.: One large company operating two factories, one in Victoria, one in New South Wales, makes a wide range of reinforcement mesh, and also makes welded wire-fence, interlocked wire-fence, and barbed wire of the twisted type and welded type. — Several small to medium-size companies or businesses make a range of welded-wire products for industrial, commercial and domestic use.

Springs, Coiled, Tension and Compression: Seven large manufacturers make coiled springs of round, wire-rod and wire, for all purposes (and also make leaf springs); one of the companies is associated with a small steel works making spring steel. — About 35 manufacturers, several medium in size, the remainder small, comprise the remainder of the springmaking activity; the manufacturers are mostly confined to springmaking. (See "Transport Equipment", Chapter 10, for comment on manufacture of leaf springs.)

Cycle Spokes: Two manufacturers. The largest manufacturer makes cycle spokes as the principal activity, and proposes to instal machines for manufacture of nipples (which are not made commercially in Australia). — The other manufacturer of cycle spokes is the largest manufacturer in Australia of wood-screws (the company is a subsidiary within the Guest, Keen and Nettlefold interests in Australia—see close of this Part). (Motor-cycle spokes are not made in Australia in any large quantity.)

Pins, Safety-pins, Bobby-pins, Paper Slide-fasteners, etc.: Three manufacturers. One makes safety-pins, household pins, toque pins, hatpins, collar pins, stitch holders, paper clips, and mouse and rat traps. — Another makes household pins, bobby pins, safety pins, paper clips and nail files (the company is a subsidiary within the Guest, Keen and Nettlefold interests in Australia—see close of this Part). — The other manufacturer makes pins, footwear findings, and is the principal manufacturer and supplier in Australia of boot and shoe machinery (the company is a branch of a leading world company in boot and shoe machinery manufacture).

Steel Wool: Five manufacturers. One company, with two establishments, also makes pot mits, filtration metal cloth, polishes and cleansers, dish cloths, and packs cleansing compounds. — One company also produces pot mits and scourers, tinsel conductor, tinsel cordage, telephone instrument and switchboard cords, and low-voltage power flexible cords. — The other companies each also make cleansers and polishes.

Copper and Brass Nails, Roves, Rivets, etc.: One large company with one establishment in each of three States and mainly concerned with steel nails, steel and brass screws, and tacks, is the principal manufacturer. — Several small manufacturers are also engaged.

Wire Products such as Baskets, Trays, Grilles, and Numerous Items for Industrial, Commercial and Domestic Use: A few of the larger wireworkers have a substantial output of miscellaneous wire products in addition to their principal products. Several medium-size companies are concerned mainly or wholly with miscellaneous wire products, and a large number of small businesses are concerned mainly with specialty wireworking.

SCREWS, BOLTS AND NUTS

Screws for Wood and Metal: Two manufacturers of WOOD-SCREWS. The largest manufacturer is a subsidiary company of the largest U.K. manufacturer of screws (see comment on Guest, Keen and Nettlefold interests in Australia, Part One, Chapter 9), and also makes metal-thread screws and nuts, bright bolts, nuts and set-screws, automotive valves and cycle spokes; two establishments are operated, one being for bright bolts and nuts. Wire is purchased from the B.H.P. group, in ready-to-use gauges. — The other manufacturer of wood-screws is also a large manufacturer in Australia of metal-thread screws and nuts, and also makes nails, tacks, washers, staples, etc. (see "Nails, etc.", above for other details of this company). — Four manufacturers of METAL-THREAD SCREWS, principally the two companies making wood-screws. One of the remaining two companies is a specialist, with a large plant for steel screws and nuts, and steel and non-ferrous rivets, including bifurcated, solid, tubular, semi-tubular; associated companies at the same address make electrical conduit fittings, switches and switch fuses, battery clips, etc., and flexible tubes. — Some repetition engineers have thread-rolling plant and make metal-thread screws usually to order for specific use. — Manufacture of metal-thread screws on auto-lathes is a commonplace activity by manufacturers for own use and by repetition engineers.

Bolts and Nuts—Black, Bright, Engine, and Other: Nine companies manufacture BLACK BOLTS AND NUTS, one (a machinery and hardware merchanting company, also associated with manufacture of machine-tools, pumps, files, roller-chain, abrasives) being particularly prominent in this field; eight of the manufacturers use rod round, wire and nut strip from the B.H.P. group, and the ninth (at present not using its bolt shop) is itself a steel works and rolls its requirements of material for bolts, nuts, and rivets. — Five companies make BRIGHT BOLTS AND NUTS, one also making bright bar, another being one of the principal makers of screws in Australia, and another being a significant manufacturer of motor-vehicle components (including forgings) and accessories. — Several large engineering companies have produced bolts and nuts in small quantities for own use when supply from the trade or imports has been acutely short.

CHAINS

Welded Link Chains: There are six manufacturers. The manufacture of the largest chains is a specialist in chainmaking, making welded link chain in short, long and stud link from $\frac{3}{8}$ in. to 2 in. diameter of material used, and is the only maker in Australia of such chain above $\frac{3}{8}$ in. diameter. Hand-made scarf welded short link chain from $\frac{3}{8}$ in. to $\frac{1}{2}$ in. is also made using imported Netherton wrought-iron. The company operates a chain-testing house approved by Lloyd's Register of Shipping, the only one in Australia for chain. (See "Steel Chains", below, for other chains and equipment made by the company.) — Two other companies are each concerned primarily with manufacture of welded link chain for a wide range of uses. One of the companies makes a range from $\frac{1}{4}$ in. to $\frac{3}{8}$ in. diameter in short link, long link, and twisted link, including block (calibrated) chain for hoisting blocks; the company also makes associated fittings such as swivels, snaps, shackles, hooks, eye bolts, rings, dees, etc., and equipment such as slings, chain cargo-nets, etc. The other company makes a range of coil chains from $\frac{1}{4}$ in. to $\frac{1}{2}$ in. and block chains from $\frac{5}{16}$ in. to $\frac{9}{16}$ in., and fittings for agricultural chains and equipment. — The principal manufacturer in Australia of hoisting blocks and associated equipment makes its own requirements of block chain and also sells block chain. — A company primarily concerned with manufacture of hand tools of various types (including stock and die sets, painter's tools, key-cutting machines) and key blanks is reported to be also making welded link chain. — The principal manufacturer in Australia of agricultural machinery makes agricultural chain and fittings and other small-link coil chain for own requirement and for sale (and also makes steel sprocket chain—see below).

Cast Link Chains: Mainly one manufacturer, a large steel-founding and general-engineering company, which makes electric cast-steel chain in short, long and stud link in large sizes (particularly for chain cable), and also cast and forged steel swivels, blake stoppers, shackles, etc.

Steel Chains for Power Transmission and Conveyors: There are three manufacturers in Australia. The company making the large sizes of welded link chain (see above) makes precision bushed-roller chain for power transmission in sizes from 1 in. to 4.06 in. pitch; long-pitched chain with or without rollers from 3 in. to 24 in. pitch; bushed chains of seven types, from about 1 in. to 4 in. pitch according to type, with attachments of all types, for conveyor systems; and specific-purpose chains such as ice chains, oven chains, camel-back link chains, double-flex chains, with attachments of various types to suit individual needs. The company is the only manufacturer in Australia of bushed-roller chain in the larger pitches, and is stated to be also the only manufacturer of fabricated steel conveyor chains. The company makes chains larger than catalogued types when required, and will make chains of special types, metric measurements, etc., for replacement of any chain made anywhere in the world. — Small-pitch precision bushed-roller chain was not made in Australia until recently, when a company joining Australian engineering interests (manufacturing and merchanting) with a leading U.K. manufacturer of

roller chain began manufacture. Present products comprise chains of medium pitch to meet an urgent and extensive demand from the agricultural-implements manufacturing industry. — The leading manufacturer in Australia of agricultural machinery makes detachable-link sprocket chain of steel, in sizes from 1.375 in. to 1.654 in. average pitch; some sizes with attachments; the chain is made for the company's own requirements and for sale.

Cast Chains for Conveyors and Power Transmission: There are three manufacturers in Australia. Two of the companies are primarily foundries, one is a repetition malleable (blackheart) foundry and a Meehanite grey-iron foundry (and making material-handling equipment, including chains, under licence of a leading U.S.A. manufacturer of such equipment); the other is a repetition malleable (whiteheart) foundry and jobbing grey-iron foundry, with a small engineering shop. Both companies make cast chains for extensive variety of uses, of types comprising detachable chain (in average pitch sizes ranging from about .064 in. to about 4.72 in.); pintle chain including griplock; pin chain; combination chain; roller chain; each with attachment links of all types. Specific-purpose chains such as tenter chain are also made. Chains of both companies are interchangeable with American and English patterns of sprocket chains. — The other manufacturer is a leading manufacturer in Australia of agricultural machinery and tractors (a branch of a U.S.A. company) which operates a blackheart malleable foundry; detachable chain is made in a range of small sizes, about .9 in. to 1.6 in. average pitch size, for company requirements and for sale.

Small Chains of Miscellaneous Types: There are about six manufacturers, three of which make utility-type link chains of steel or brass, and three of which make mostly chains for personal use in precious metals, gilding metal, etc. One company, making a wide variety of small stamped metal products, including cupboard latches, barrel bolts, eyelets, grommets, and wire products such as paper fasteners, curtain rings, etc., appears to be the only manufacturer in Australia of chandelier, mirror, electrolier and bead chains, and also makes jack chain. — One of the largest manufacturers in Australia of builders' hardware and of small repetition products in metal makes jack chain and knotted chain in a wide variety of gauges. — A manufacturer of spouting and of nails, also makes knotted chain. — A subsidiary company of one of the largest of the jewellery-manufacturing companies in Australia is a specialist in manufacture for trade of trace and curbed chain in precious and near-precious metals, gilding metal, brass, etc. (and also does wire drawing for own requirements and for trade as an ancillary activity). — A specialist chain-making company, recently established, is making snake ("Brazilian") chain, the first manufacturer to do so commercially in Australia; all shapes are made, in precious and base metals. Curbed and trace chains are also to be made. — The largest manufacturer in Australia of watch-cases also makes trace and curbed chains in precious and semi-precious metals for own requirements (such as for wristwatch "straps"), and is now tooling to make snake chain.

SERVICE ACTIVITIES—TRADE SERVICES, SUB-CONTRACTING, JOBBING, MAINTENANCE AND REPAIR

The Australian engineering industries have to great extent built themselves on and around foundations laid by a small number of general-engineering organisations in each State which began operating in the late 1800's and early 1900's. Most of these were concerned with the manufacture, repair and maintenance of mining and agricultural machinery in particular, with other types of heavy engineering also claiming attention. Typical of the now large general-engineering firms which were set up late in the last century are Thompsons (Castlemaine) Ltd., Castlemaine and Melbourne, Vic., first established in 1852; Morts Dock and Engineering Co. Ltd., Sydney, N.S.W. (1875); Walkers Ltd., Maryborough, Qld. (1888); The Clyde Engineering Co. Pty. Ltd., Sydney, N.S.W. (1898).

With the growth of the economy, including the increased tempo of manufacturing resulting from the 1914-18 War, and the establishment of the major iron and steel works, these organisations expanded their activities and new companies came into being. Some branched into new fields and today occupy leading places in specialised fields of engineering such as shipbuilding, construction of railway rolling stock, heavy specialised machinery, structural steelwork, boilermaking, etc. Notwithstanding their emphasis on certain fields, these firms have almost without exception maintained their original characteristic of general engineers and are usually available for jobbing engineering spreading over an extremely wide range. In addition to whatever specialised manufacture they may be engaged in they will undertake both light and heavy engineering ranging from turning, milling, boring, etc., to heavy plate and tank work. Most operate foundries and forge equipment and provide the services of design and draughting sections, of foundry and patternshop, of machine shop, toolroom, and of maintenance and installation sections. Typical of the larger general-engineering companies established after the 1914-18 War are A. E. Goodwin Ltd., Sydney, N.S.W., established in 1926; Hadfields Steel Works Ltd., Sydney, N.S.W. (1930); Cockatoo Docks and Engineering Co. Pty. Ltd., Sydney, N.S.W. (1933), which leased a Government-owned dockyard, shipyard and engineering shops.

There is thus in Australia a solid nucleus of well-established general engineers able to provide a wide range of services covering light and heavy engineering. Around this nucleus there are many hundreds of small to medium-sized firms, ranging in employment from one-man owner-operated up to and over 100 employees, which could be included in the numerous establishments engaged in general jobbing engineering. These differ greatly in type and scope of work undertaken. They range from small country town motor-service stations equipped with a few power-operated tools, which will effect repairs to farm machinery, motor vehicles, household appliances, etc., and which will at times make replacement parts, to large general-

engineering organisations employing several hundred workers which traditionally will accept overhaul and repair work spread over a wide range of items and will make small or large single replacement parts or batch produce large quantities. As previously stated some of the larger general-engineering plants operate their own foundries and ancillary services and are exhibiting a tendency to concentrate in particular engineering fields.

Jobbing engineering firms both large and small are to be found in all States, particularly in the suburbs of the capital cities, but it is not unusual to find many located in the inner city areas. Practically each medium-sized to large-sized country centre would be served by at least one jobbing engineer.

Some jobbing shops devote part of their activities to production and manufacturing on their own account or on a sub-contracting basis, and part to wholly jobbing and maintenance work. Some may be said to operate what amounts to repair and maintenance shops for manufacturers or suppliers of equipment who do not wish to directly carry out such activities. Combinations of these various activities obscure the lines of demarcation between the different types of jobbing engineers.

General jobbing engineering embracing light and medium engineering work is well covered by numerous establishments in each State. The services available, and for which adequate capacity appears to exist, cover turning and fitting, various other machining and finishing operations, press work, fabricating, welding and in some cases the making of tools, gauges and dies, and engraving and other special engineering services. Most of these organisations have essential machine tools such as general-purpose lathes, milling machines, drills, power hacksaws, etc., together with welding apparatus. Some may specialise in such services as grinding, gear cutting, welding, diecasting, pressing and stamping, toolmaking, etc., and as with the larger heavy-engineering firms there is a tendency to become associated with particular industries or manufacturers. Thus there are many jobbing engineers specialising in maintenance and repair of such equipment as hydraulic, mining, marine, electrical of various kinds, automotive, refrigeration, food-processing, steam raising, etc.

It has already been stated that specialised services are offered by many jobbing engineers. Some of the more important of these services are described hereunder—

FOUNDRIES: There are about 418 ferrous foundries and about 380 non-ferrous foundries in Australia, including those that function as part of establishments engaged in general engineering and other metal-products manufacture. Most of the largest producers are also engaged in other manufacture which constitutes their major activities. By far the greatest number are concentrated in and about the principal industrial centres, particularly in N.S.W. and Victoria. (See also Chapter 9 for further details of ferrous and non-ferrous foundries.)

FORGING: Most of the forging capacity in Australia is operated by general-engineering plants or by manufacturers of heavy equipment and machinery. Ten establishments have heavy press forges, including one of 5,000 tons capacity now being installed. About 45 establishments have drop stamps; about 185 have steam or pneumatic power hammers; and seven firms have hot-brass pressing capacity. (For further details of firms and capacity, see Chapter 9.)

FINISHING OF METAL (enamelling, plating, polishing, etc.): There are a large number of establishments in all States of the Commonwealth which provide a trade service for the finishing of metal products. Some firms are specialists in the finishing and packing in selling condition of consumer products made elsewhere.

PRESSINGS: Numerous firms specialise in light to medium pressings, and they are to be found in all States. A small number specialise in precision pressed parts and a smaller number again specialise in heavy pressings. Most metal pressing and stamping specialists also specialise in die making. One leading firm in this field located in South Australia has a line of modern single-acting and double-acting presses, including 750-ton "Clearing" presses handling capacities of upwards of 75 tons. Specialists in this field will design, tool and handle the complete job from order stage to finished product.

REPETITION ENGINEERING: Turning work involving the use of automatic or semi-automatic machine tools is carried out by numerous firms in Australia, many of which make and market specific end products. There are, however, only about 100 small to medium-sized plants which could be described as repetition engineers, offering their facilities on a sub-contracting basis for particular jobs. About two-thirds of these are situated in the suburbs of Melbourne and Sydney with Victoria predominant in the light-engineering field and New South Wales in the heavy-engineering field. Some of these firms over a period of time have taken on special items or tend to engage themselves in selected fields. As with most jobbing-engineering firms they tend to associate themselves on a sub-contracting basis with particular manufacturing interests. One Victorian firm typical of the leading firms in this field has a battery of fourteen automatic lathes (in addition to fourteen capstan lathes and other machine tools) with a capacity for work up to 1½ inches diameter; orders for 5,000 parts are considered for a minimum batch on automatics by this firm. The total number of all types of single-spindle and multi-spindle automatic lathes in Australia would be about 2,000 machines, but outside the owners of these machines there are hundreds of firms who can carry out similar work on capstan and turret lathes, etc.

TOOLS AND GAUGES: A number of firms in each State specialise in the production of custom-made tools and gauges. The main growth in this field developed during and since the 1939-45

War, before which there were only two or three firms in this field. Some firms offer their services for the design of special tools and gauges and will also offer specialised machining or grinding or other finishing services. It is believed that further opportunities for the establishment of specialised tool and gauge services exist in all States.

DIE MAKING AND SINKING, AND ENGRAVING: There would be about 200 firms throughout Australia, mainly concentrated in Sydney and Melbourne, and generally small to medium in size, which undertake die making and die sinking for the general engineering and plastics-products trades. Few of these have extensive equipment—the more elaborate and expensive equipment being in the hands of leading manufacturers of products requiring dies. Many combine engraving as a specialist activity, but there are several engravers of nameplates, etc., who confine their activities to engraving only. Some die makers also make their services available for jobbing production of tools, jigs, fixtures and gauges as well as metal stampings.

DIECASTING: There are firms in each State specialising in diecasting for the trade, with one or two firms predominating in Victoria and New South Wales. There would be about sixty firms in this field throughout Australia, all of which would undertake general sub-contracting work. Many of these are engaged in other activities and some make goods for direct sale. Both injection and gravity castings are catered for, and die making is usually an associated activity. There is probably greater scope for gravity diecasting than is at present employed. There is only a small amount of specialisation in investment casting for industrial purposes, and some States are in fact without this service.

GRINDING: Grinding facilities, covering tool and cutter grinding, cylindrical, surface and centreless grinding, are available in all States. Most firms which undertake this work also make other machining facilities available. Some firms specialising in grinding for the trade also operate engine reconditioning services, catering for cylinder grinding and sleeving, crankshaft grinding, etc. At least four firms grind hard metal, such as tungsten-carbide, to provide form tools to stock and order; one of these firms is newly established in Australia and is a subsidiary company of a leading U.K. manufacturer of multi-spindle automatic lathes.

GEAR CUTTING: In addition to a number of manufacturers which carry out gear cutting for their own products there are available in each State firms which specialise in providing gear-cutting services for the trade. Some of these are fairly large organisations which, in addition to specialising in gear cutting, make complete items for sale. Industrial gears for practically all purposes can be made by existing industry which is located largely in New South Wales and Victoria, these two States accounting for about thirty specialist firms. Automotive gears are produced mainly in New South Wales where two firms dominate the field, and to a lesser extent in Victoria where there are four main operators, one of which is outstanding in this field. One of the largest industrial gear-cutting organisations in Australia, John Welsh Pty. Ltd., Melbourne, Vic., has capacity to cut spur and helical gears, sprockets and worms from very small size to 28 feet diameter, and bevel gears from very small size to 9 feet diameter. Double-helical gears for turbine reduction gears to Admiralty pattern are made in Australia up to about 12 feet in diameter; there are only three producers—John Welsh Pty. Ltd., Melbourne, Vic., engineers and gear cutters; The Broken Hill Co. Ltd., at Whyalla, S.A., iron and steel makers, shipbuilders, ship-engine builders, and The Commonwealth Ordnance Factory, Bendigo, Vic.

PLUMBING, COPPERSMITHING, TUBE BENDING, METAL WORKING: Mostly small to medium-sized firms are operating in these fields, and they are to be found in fairly adequate numbers in most cities and towns. Many combine these activities with gas fitting and installation, repair and maintenance of hot-water systems. The small intake of apprentices into these trades in recent years has given rise to some concern over availability of skilled tradesmen and there is undoubtedly an inability at present to cater for all requirements without long delays being involved.

Part Two: Outline of Capacity of Manufacturing Activities

THE manufacturing activities dealt with in this chapter are those which provide the greater part of metal capital goods made in Australia. The chapter also includes all those articles of equipment and apparatus which are not dealt with in other chapters, including all those personal, social and similar articles which in statistical classifications are usually made the subject of a miscellaneous category. (See Appendix IV, "Explanatory Comment on Statistics and Terminology" and the introduction to Part One of this chapter.) The activities are set out in the following sequence—

Plant for Some Specific Industrial Activities

Plant of a General Nature

Equipment Not Elsewhere Included, Particularly for Professional, Technical, Social, Domestic and Personal Use

Sheetmetal Working, Finishing (Coating, Polishing, etc.), Wire Working, Screws, Bolts and Nuts, Chain of all Types

Service Activities—Trade Services, Sub-contracting, Jobbing, Maintenance and Repair.

PLANT FOR SOME SPECIFIC INDUSTRIAL ACTIVITIES

AGRICULTURAL AND PASTORAL PLANT

The main factors in the demand for agricultural implements and machinery are the replacement of existing machines, the greater mechanisation of existing holdings and the expansion of agricultural activity. The relative importance of those factors has tended to change in recent years. The market is still largely one of replacement, but the requirements for new usage have grown considerably as farmers have sought to compensate for the shortage of manual labour by the use of agricultural implements and machinery. Furthermore, the demand for this equipment is very susceptible to changes in farm incomes. The relatively greater increase in farm incomes in 1949-50 and 1950-51 compared with incomes in other sectors of the economy has tended to result in farmers hastening the rate of replacement of worn-out and obsolete units, and also the rate of mechanisation, particularly of small farms. These factors, together with accumulated backlogs due initially to wartime shortages, have tended to raise the demand much above earlier long-term levels. There has been some reaction in 1952, however.

Over the next decade the needs of a rapidly expanding population (8.6 million at early 1952, estimated 10.5 million at 1960) will require an increase of supplies of basic foods of the order of 30 to 40 per cent. This will necessitate an intensification and an expansion of existing farming. It is clear that these factors will add substantially to the long-term annual rate

of demand for agricultural implements, which might well result eventually in an even higher permanent level of demand than the current level.

The manufacture of agricultural implements and machinery in Australia is chiefly undertaken by large organisations, since the nature of both the market and the industry favours large-scale production. Several companies have capital funds in excess of £1 million and have international connections. Their plants are extensive and largely self-sufficient, covering all phases of production as well as the assembly and marketing of products made by overseas associates and research. Output is generally not large enough to warrant continuous-line production, but batch production on a large scale is employed, which—with good planning—lends itself to a high degree of manufacturing efficiency. The larger companies cover a wide range of equipment and generally produce all necessary components, but the smaller firms tend to concentrate on particular lines and to subcontract many of the parts.

The following table sets out the output of the main items of agricultural implements from all factories (that is, including factories making such plant as a lesser activity and thus not classified in official statistics as "agricultural machines and implements" works) for the years 1938-39, 1948-49 and 1949-50—

PRODUCTION:	1938-39		1948-49		1949-50	
	no.	£	no.	£	no.	£
Ploughs—						
Made	11,166	218,298	8,417	459,997	12,156	390,293
Assembled	881	(a)	77	(a)	407	(a)
Cultivators—						
Made	8,196	219,933	12,475	603,880	11,684	738,896
Assembled	305	(a)	308	(a)	414	(a)
Scarifiers	(a)	(a)	1,315	58,839	1,678	90,351
Harrows—						
Made	20,983	38,731	23,486	165,454	30,687	315,730
Assembled	1,259	(a)	100	(a)	466	(a)
Drills and Combines—						
Made	1,828	107,585	3,625	517,855	4,206	612,897
Assembled	(a)	(a)	223	(a)	327	(a)

Other planters	1,107	11,787	2,722	55,503	2,057	69,863
Harvesters—						
Made	2,568	435,437	2,271	1,068,381	2,411	1,192,002
Assembled	(a)	(a)	242	(a)	517	(a)
Mowers	994	28,014	3,802	244,810	3,527	(b)
Hay Rakes—						
Made	1,524	16,761	2,070	58,127	2,150	65,083
Assembled	(a)	(a)	103	(a)	110	(a)
Windmills	(c)	163,549	13,517	391,037	14,711	601,779
Chaffcutters	823	22,326	1,051	62,110	550	(b)
Milking Machines—						
Made	378	18,692	1,210	90,396	2,237	159,668
Assembled	713	(a)	(d)	(a)	1,043	(a)

(a) Details not collected; (b) quantity only collected; (c) quantity not available; (d) not available for publication.

The value of output of agricultural implements in Australia, exclusive of tractors, for 1949-50 totalled £14.18 million, representing an increase of about £4 million over the value of output in 1948-49.

The following table presents the value of output of some items of agricultural and pastoral plant produced in 1949-50, showing the output of factories classified as agricultural-implement factories and the total value for all factories—

PRODUCTION:	1949-50	
	Factories Classified as Agricultural Implement Fac- tories	All Factories
	£	£
Cultivators made	702,844	738,896
Parts for tillage implements	450,270	499,754
Parts for seeding and planting implements	220,730	273,580
Hay-baling presses	194,960	194,960
Hay rakes made	65,083	65,083
Parts for hay rakes	655,309	665,503
Windmills	419,638	601,779
Parts for windmills (not engines)	166,590	233,508
Milking-machine parts	20,807	247,708
Dairy and butter-making ma- chinery	203,733	711,606
Feed grinders	8,509	9,237
Bag loaders	10,940	131,783
Wool presses	59,587	81,109
Earth scoops	10,893	52,438
Sawbenches—		
Portable	91,404	108,314
Stationary	59,768	89,118
Tools (garden, farm and field)—		
Axes	—	130,028
Mattocks	—	14,966
Crowbars	—	3,995
Lawnmowers—		
Petrol engine	15,103	51,436
Electric motor	48,133	345,254

In addition to the above, types of plant also made by manufacturers not classified in official statistics as "agricultural machines and implements" works includes ploughs, scarifiers, harrows, drills and combines and other planters, harvesters and reaper-threshers, the engine portion of windmills, fruit graders, chaffcutters, milking machines, fertiliser spreaders, farm elevators. The quantity and/or value of such "outside" production are not available for separate publication, indicating

that only one or a few manufacturers are engaged in making each type of product.

Australian supplies of agricultural implements and machinery (excluding tractors) come mainly from local production. In the year 1949-50, imports of this equipment totalled £1.4 millions, an increase of £1 million over the previous year. The chief items imported included ploughs and parts, cultivators (all types), fodder harvesting machinery, power and hand mowers and parts, and garden implements. (All imports are now subject to licence—see Appendix II.) Exports of agricultural implements and machinery are small, representing only about 4 per cent. of the value of output.

Australian production is for a few items still inadequate to meet the overall current demand, although the backlogs have been markedly reduced in recent months. Among the main sub-groups, there are still some shortages of STANDARD CULTIVATION MACHINERY such as PLOUGHS, CULTIVATORS and HARROWS, but these are not as acute as they were in 1951. Production of SEEDING AND PLANTING IMPLEMENTS is now generally adequate to meet the current demand. HARVESTING MACHINERY in the main HEADER and STRIPPER HARVESTERS, are still in short supply. In the miscellaneous group such as FERTILISER SPREADERS, FEED GRINDERS, CHAFFCUTTERS, WINDMILLS, SPRAYS, etc., the demand exceeded the supply for some years until 1951, but owing to changing market conditions current supplies are now reasonably adequate for the current demand.

The industry has sufficient capacity to meet the demand for most items of equipment, provided adequate supplies of materials and labour are available. Spare parts production has been maintained at a satisfactory level. The continual expansion of the Australian industry should go a long way towards meeting Australian requirements, and may also enable an expansion of the export trade, which is mainly for types of machinery not used locally.

(AGRICULTURAL TRACTORS are dealt with under the heading "Tractors" later.)

AUTOMOTIVE SERVICE-STATION EQUIPMENT

Equipment for automobile service stations is well provided for, and manufacture covers a wide range, from hydraulic hoists, air com-

pressors, breakdown equipment, etc., to general garage equipment.

BOOT AND SHOE PLANT

Production of boot and shoe machinery is largely in the hands of one overseas organisation which meets more than 80 per cent. of the requirements. Local manufacture is

limited to such equipment as skiving machines, staplers, rough rounders, certain types of finishing machines and various kinds of presses, for all of which there is a fair de-

mand. In the case of the more complex machinery, such as automatic assembling plant, it can be assumed that the high capital

outlay involved coupled with a limited demand has rendered local manufacture unattractive.

BRICK, TILE AND POTTERY PLANT

The demand for machinery for making clay bricks and tiles is limited to some extent by the conservatism of most of the clay brick and tile manufacturers, brought about largely by a widely fluctuating market for their products in the past. Most of the machinery installed in the brick and tile works in Australia has been produced in the Commonwealth, and much of it has been in use for many years. This machinery includes brick and tile presses, pan mills, crushers, mixers, extension machines, cutting machinery, etc. Generally these machines are made to order to a design established by the machinery manufacturer. Some of the plant in use could be replaced by new and improved equipment with benefit to the industry, but brick and tile manufacturers frequently are loth to commit themselves to

the capital outlay involved in re-equipping their works at prices at present ruling. Australian production of brick and pottery machinery in 1948-49 was valued at £122,388, and in 1949-50 at £188,021.

Most of the major cement-tile works in Australia have installed plants of Australian design and manufacture. These plants operate automatically and produce Marseilles-pattern tiles with headlock. An automatic plant in use in South Australia follows an overseas design. Other plants of manual and semi-automatic types have been produced in Australia.

Cement brick and sand-lime brick machinery is partly imported and partly Australian made.

CHEMICAL AND PHARMACEUTICAL PLANT

Requirements of chemical and pharmaceutical equipment in Australia are generally of a specific nature. These are fairly well catered for by general engineering firms who have gained experience in the manufacture of specially lined vats to suit particular products; ink refiners and similar equipment; a limited

range of digesters and autoclaves; tableting machines; and such items as ball mills, which are referred to elsewhere. Imports are restricted to certain types of standard equipment, such as special autoclaves for which there is only a limited demand.

CLOTHING PLANT

Australia depends almost entirely on imports for sewing machines, overlocking machines, buttonholing machines and other fancy stitching machines. Branches of overseas organisations are established here which assemble, repair and overhaul machines in addition to their main activities of selling and distributing. A few local firms also assemble machines, using imported heads. However, a domestic sewing machine head is made by the Commonwealth Small Arms Factory at Lithgow, N.S.W., for one company. Pressing machines, benches, legs, shafts, etc., and a few power-operated cutting machines are also made in Australia. Accessories such as wooden conveyor chutes are made locally, often by the large-scale clothing manufacturers which use them. There is little import of such items.

In 1948-49, 26,325 sewing machines were assembled in Australia; and in 1949-50, 36,069

domestic type and 1,459 industrial type were assembled. Value of imports for 1949-50 and 1950-51 was—

IMPORTS:	1949-50	1950-51
	£	£
Sewing and stitching machines, for all purposes—		
Industrial and special purpose	912,720	1,250,884
Appliances and accessories ..	160,505	234,012
Sewing machines, treadle or hand, household type—		
Machine heads	739,791	1,173,959
Stands, including transmission, cabinets, covers, tables	143,477	258,388
Sewing machines, household type, electrically operated	10,074	71,217
Sewing and stitching machines, n.e.i.	24,429	28,453

The principal sources of imports were the United Kingdom and the United States of America. All imports are now subject to licence—see Appendix II.

CONSTRUCTION PLANT (NOT TRACTORS)

The production in Australia of earthmoving, excavating and construction equipment has developed, particularly over the last ten years, into an important secondary industry. The items of equipment manufactured include powered and drawn scrapers and graders, shovel loader attachments, dozer blades and attachments, power shovels, draglines and similar types of excavators up to 2½ cubic yard capacity. The post-war expansion of the industry is indicated by an increase in the total value of output of excavating and mining machinery as recorded by the Commonwealth Statistician from £1.2 million in 1946-47 to £4.2 million in 1949-50.

Despite improved material supply, production in 1952 has been much reduced largely because of reduced public works demand. The capacity for manufacture of many individual items is much above present levels of output.

Australian production of construction and excavating equipment for the years 1948-49 to 1950-51 is set out in the following table—

PRODUCTION:	1948-49	1949-50	1950-51
	no.	no.	no.
Power shovels, draglines and similar classes of excavators	97	98	75
Rock buggies	32	36	23

Dozer blades and attachments	350	784	1,152
Power-control units	(a)	634	762
Logging winches	(a)	(a)	200
Shovel-loader attachments	440	661	612
Graders—			
Heavy powered	430	70	130
Medium and light powered		453	487
Drawn		343	583
Scrapers	200	162	299
Scoops	900	591	975
Rippers and rooters	300	551	978
Road ploughs	250	271	881
Road rollers	55	50	50
Earth consolidating (including sheep's foot) rollers	25	30	83

(a) Not available.

Source: Division of Industrial Development.

The value of imports of construction and excavating equipment (including rock-cutting and dredging machinery) increased from

IMPORTS:

	1948-49		1949-50		1950-51	
	no.	£	no.	£	no.	£
Road rollers (power operated) including scarifier attachments	9	9,952	38	51,166	57	56,292
Graders, scrapers and scoops	—	7,810	—	162,764	—	52,174
Earth and rock-cutting, dredging and excavating machinery	—	114,453	—	273,325	—	813,702
Dredging and excavating machinery of the shovel, dragline or similar type	—	901,988	—	3,366,082	—	2,391,214
Roadmaking machinery, n.e.i., and concrete mixers	85	138,855	259	325,400	634	740,566
Detachable appliances for attaching to tractors	33	57,344	381	101,748	1,342	157,002
Totals	—	£1,230,402	—	£4,280,485	—	£4,210,950

Estimates of demand for construction and excavating equipment in 1952 are set out below—

DEMAND ESTIMATES:	Estimated Demand 1952
	no.
Excavators under 1 c. yd. capacity	130
Excavators 1 c. yd. capacity and over	40
Rock buggies and dump waggons	100
Dozer blades and attachments	1,200
Power-control units	900
Logging winches	500
Shovel-loader attachments	600
Graders—	
Heavy powered	140
Medium and light powered	400
Drawn	500
Scrapers	270
Scoops	800
Rippers and rooters	700
Road ploughs	500
Road rollers	70
Earth consolidating (including sheep's-foot) rollers	120

The demand for construction and excavating equipment continued to expand for many years until about the middle of 1951, but since then the demand has eased. The high backlogs of demand of two years ago have now been eliminated for most items of equipment due to rising levels of production and the reduction in demand below the peak levels of 1950-51.

Variations in the level of public works have a substantial effect on the demand for this type of equipment—present evidence indicates that it may be difficult in the future to find sufficient finance from public works to sustain recent levels of activity. Furthermore, more stringent financial conditions generally are tending to ease the demand. Large stocks of equipment have accumulated in 1952.

The manufacture of ROADMAKING MACHINERY is undertaken mainly by the makers of earthmoving and excavating equipment. The items generally manufactured in-

clude rollers of all types, rippers, rooters and road ploughs, scoops, emulsifying units, bitumen heaters and spreaders and concrete mixing and laying equipment. The value of output of this type of equipment increased from £0.67 million in 1946-47 to £1.5 million in 1949-50. Although certain types of equipment, such as large concrete-mixing plant and batch mixers for bitumen, are imported, the Australian industry is able to satisfy the bulk of requirements, and firms with overseas affiliations will probably extend to these lines if local demand should warrant such a step.

The main possibility of consolidating the development of the Australian manufacture of earthmoving, excavating and construction machinery is in the field of small to medium sized machines. There is at present no manufacture of very heavy earth-moving equipment such as power shovels and draglines above 2½ cubic yards capacity, but the small demand for machines of this size has not hitherto provided any continuing market or strong encouragement to establish local production. On the other hand, there would appear to be a market for the Australian production of excavators between 2 and 3 cubic-yards capacity, although consideration would have to be given to the local selling price in relation to that of the imported machine.

With the exception of tractors and very large excavating equipment it appears that Australian manufacturers generally have ample capacity to meet the Australian demand.

The production of SPARE PARTS for excavating and mining machinery would appear to be a potential field for manufacturing enterprise as an appreciable dollar allocation is at present being absorbed in covering such requirements. Diversity of the range of requirements may, however, severely limit the field of manufacture.

FOOD-PRODUCTS PLANT, INCLUDING FOOD PACKAGING

The manufacture of food-processing machinery covers a very wide variety of equipment, of which the following groups are mainly representative.

BAKERY MACHINERY is well catered for. The range made includes ovens of all types for gas, electric, and fuel firing, dough breaks and mixers, general-purpose mixing machines, biscuit-cutting and biscuit-making machines, and much special purpose equipment. The most modern developments are usually incorporated into machinery made because of overseas firms establishing themselves in this country or as the result of travel by representatives of the local manufacturers. The industry is generally regarded as capable of meeting normal requirements.

BUTCHERS' MACHINERY made in Australia includes an appreciable quantity of equipment produced by refrigeration manufacturers such as cold rooms, brine tanks, freezing chambers, etc. Much of the remainder is specialised equipment such as conveyors for abattoirs and cold-storage plants, digesters, boiling-down plant, sausage machines and similar items. Owing to the particular and specific nature of such equipment its manufacture is essentially local in character, and imports are negligible.

The manufacture in Australia of **CANNING MACHINERY** is a very well developed industry, due probably to the fact that the canning industry itself is one of the most important in food processing. The equipment produced covers practically the entire range of canning plant, and the quality compares favourably with world standards. Included in the range manufactured are high-speed canmaking and seaming machines, shellers, peelers and paring machines, graders and sorters, pitters, seeders and steamers, juice extractors, syrupers, pulpers, cooking tanks and specialised equipment for complete-plant installations. At least two of the leading manufacturers have well-established overseas associations with which there is a constant interchange of technical knowledge. Output for 1949-50 was valued at £1,027,320.

The greater part of **FLOUR MILLING** and allied machinery is obtained from overseas. Imports for the year 1949-50 were valued at £186,650. There are three companies, two with overseas associations, which have manufactured a limited quantity of equipment in Australia, but purifiers, cleaning machinery and conditioners are imported, local activity being confined to auxiliary plant and repair services.

That the manufacture of **COCOA AND CONFECTIONERY MACHINERY** in Australia

is not sufficient to meet requirements is illustrated by a comparison of the Australian output of £71,950 in 1949-50 with imports during the same period of £103,250. Equipment such as mixing and roasting machines, ball mills, steam-jacketed pans and other stainless-steel items, cutting machines and some wrapping and cartoning machines are made in Australia, but there has been little or no attempt to produce conches, melanges, enrobers or chocolate machinery generally. One well-known overseas maker of this type of plant has arranged, by licence, for the production of an appreciable range of food-processing machinery, but has so far not made any of the above items.

The manufacture of **MILK-PRODUCTS MACHINERY** in Australia is mainly confined to five or six large, well established firms, two of which have overseas associations. There are other firms, generally in the refrigeration and sheetmetal-working fields, which specialise in the production of specific items. Equipment manufactured includes pasteurisers, coolers, clarifiers, butter churns, butter cutters, homogenisers, milk-can and milk-bottle washers, bottle fillers, glass-lined waggons, bulk-storage plants, cheese vats and curd mills. The value of output for 1949-50 totalled £711,600. Imports for the same period were valued at about £492,000, the majority of which represents purchases of cream separators (60 per cent.) which are not made in Australia, and certain types of pasteurisers and coolers (25 per cent.). The demand for this type of equipment is strong and is likely to be maintained at high levels.

SUGAR MACHINERY is produced, usually to specific orders, by general engineering establishments, although there is at present a tendency to specialise in this direction. All requirements are being met.

BEVERAGE MACHINERY manufactured in Australia includes a wide range for aerated-water manufacture and the wine industry, with limited types for breweries and distillers. The equipment made includes carbonating machines; crushing and syruping machines; agitators and mixers; bottle washing; filling and crowning machines for aerated-water and cordial manufacture; wine filters, grape mills, stills, pumps and other special and general equipment for the wine and spirits industries. There are firms which specialise in the manufacture, installation and maintenance of machinery for these industries, and in most cases these firms either manufacture the entire installation to order, or subcontract certain portions and carry out the installation work.

GAS MAKING AND RETICULATION PLANT, INCLUDING GAS METERS

Piping for gas reticulation is made in Australia (see "Steel Pipes, Tubes and Fittings", Chapter 9) as well as pipe fittings, although local demand has exceeded local supplies for the last six years. The design and laying of reticulation systems is carried out by the gas-supply organisations.

Most of the plant comprising a gas works is erected on site, generally from units made by heavy-engineering firms. Gas holders have been made by several such organisations. The major gas-supply organisations do their own engineering design and sub-contract items such as purifiers, retorts, washers, to several leading engineering firms.

Smaller gas companies employ the services of a firm of gas engineering consultants, which has overseas affiliations. Except for a few special items such as large gas boosters, practically all gas-making plant can be made economically in Australia. In 1939 about 80 per cent. of this type of equipment was supplied locally, but during the last few years some equipment such as gas holders and piping have been imported because of quicker delivery. The local supply position has improved recently. The development of direct gasification of brown coal (see Chapter 1) will require novel imported equipment.

Five companies manufacture GAS METERS and FITTINGS, three in New South Wales and two in Victoria. In addition the principal gas company in Victoria has for many years manufactured its own meters; as production has recently overtaken demand the gas com-

pany has now discontinued manufacture. In the year 1949-50, 3,450 meters were imported to a value of £15,400. The total value of Australian output of gas meters and fittings in 1949-50 was £663,000.

HOTEL AND CAFE KITCHEN EQUIPMENT, HOTEL CELLAR AND BAR EQUIPMENT

A very wide range of articles included in this category are made in Australia in sufficient quantities to meet the bulk of local requirements. Detailed information regarding the manufacture of electrical equipment such as electric stoves and ranges, food mixers, grillers, toasters, dish-washing machines, etc., is contained in Chapter 11, "Electrical and Electronic Products". Refrigeration equipment is covered in the section "Refrigeration Plant", this chapter. The manufacture of stainless-steel sinks is referred to in "Sheetmetal Working", later this chapter. For information on plastics and rubber beer-carrying pipes, see, respectively, Chapter 7, "Plastics Products" and Chapter 8, "Rubber Products, Reconditioning of Tyres". Apart from the above items, there is little specific statistical information available regarding Australian production, imports or exports of hotel and cafe kitchen plant, and hotel cellar and bar equipment. Import statistics show the following items, but these include equipment for both commercial and domestic use—

IMPORTS:	1949-50 £	1950-51 £
Cooking utensils, cast iron (plain or tinned)	18,560	15,235
Kitchenware (other than electrical heating and cooking appliances) manufactured of wire, tinned plate, plated metal, or a combination of such materials, with handles of any material or without handles; metal stove toasters; dish, pot, pan or plate washers, n.e.i., (of any material); plate scrapers and the like; metal soap racks; can openers; metal soup ladles; cooks' forks; corers and peelers; egg whisks or beaters; asbestos mats; ice picks	49,071	69,353
Dish, pot, pan or plate washers of metal and textile combined, and material for use in the manufacture thereof	355	245
Kitchen and cooking utensils, n.e.i.—		
Iron and steel	18,555	19,002
Aluminiumware	506,952	244,659
Enamelled ware	44,766	63,302

LAUNDRY AND DRY-CLEANING PLANT

The manufacture of laundry and dry-cleaning equipment is well established, there being about ten organisations engaged therein, of which three have overseas connections. The quality of machinery produced is high, and manufacturers generally are well abreast of

modern developments. Apart from the heavier and larger types of ironers, hydroextractors and washing machines, the range is well covered and, within that range, the industry is capable of meeting requirements, while imports are at present negligible.

METALWORKING PLANT

The manufacture of SHEETMETAL-WORKING machinery is well established, although there are relatively few firms engaged in this field. Deliveries are at present subject to some delay, and imports are substantial, being valued at £812,980 in 1948-49, £1,122,600 in 1949-50 and £1,556,060 in 1950-51.

The MACHINE-TOOL industry in Australia has developed considerably over the last decade. In 1939, the number of companies which could be considered as manufacturers of machine tools was limited, but wartime requirements caused a rapid expansion of the industry. The growth of other branches of industry during the post-war period has resulted in a continued expansion of the machine-tool industry, and some increase in the range of products manufactured as compared with the pre-war period. There are now about forty companies (mainly small and medium-sized) engaged in the manufacture of various types of machine tools. Value of output for 1949-50 was £3,523,550. The bulk of production is made up of CENTRE LATHES of up to 8 inch centre height and a variety of DRILLING MACHINES, GRINDING MACHINES, GEAR HOBBER, POWER SAWS. Lathes up to 20-inch centre height are produced.

Special-purpose machines are constructed to order, but the industry generally limits itself to the production of general-purpose machines of small and medium size. The present quality

ranks high by overseas standards, and considerable attention is being paid to the incorporation of the latest improvements in design.

After the war, surplus government-owned machine tools were rapidly disposed of to industry, but the continuing demand from new and extended industries resulted in importations to the extent of £3,000,000 in 1947-48, the chief sources of supply being the United Kingdom and the U.S.A. There was a slight decline in 1948-49, when total imports fell to £2,200,000, the imports from dollar and hard-currency areas being about £500,000 less than the previous year. Imports for 1949-50 rose to £2,520,000, while imports from dollar and other hard-currency areas rose by £66,000 to £570,000. This indicates that the decline in 1948-49 was due to import restrictions rather than a lessening of demand. Milling machines (other than gear milling) to the value of £416,640, and £277,000 were imported during 1948-49 and 1949-50 respectively, while grinding machines (other than gear grinders) to the value of £258,870 and £354,880 were imported during the same periods.

TOOLS and ACCESSORIES for MACHINE TOOLS have been made in Australia for many years, but prior to 1939 the quantity produced was of little significance. Items now being manufactured include drills and reamers; taps, dies and chasers; milling cutters;

tool tips and forms of hard metal; arbors; boring bars; centres; chucks; circular tables; holding devices; and many other items. Production of such equipment has increased considerably over recent years, and demand is now being reasonably met. Imports were valued at £272,800 in 1949-50, of which drills, cutting tools and chucks formed the largest part.

There are toolmaking businesses and companies specialising in the production of JIGS and FIXTURES, DIES and GAUGES to meet individual requirements, but many manufacturers requiring these items make their own because there has been a large demand which cannot readily be met due mainly to the shortage of skilled toolmakers.

There are numerous firms in Australia capable of making GAUGES of all standard types. Four companies, however, confine their activities almost exclusively to the manufacture of

gauges and other precision equipment. This branch of industry expanded considerably to meet wartime defence requirements, but a large reversion to normal conditions has taken place.

A complete range of ELECTRIC (see later reference) and OXY-WELDING plant and equipment is manufactured in Australia. The manufacture of oxy-welding equipment is largely in the hands of one company with United Kingdom principals, and which, through subsidiary companies, manufactures a wide range of welding machines and electrodes. The items manufactured include acetylene generators, gas cylinders, blowpipes, cutters, regulators, gauges, nozzles, torches and general ancillary equipment. Neither production nor import statistics are available, but it would appear that sufficient capacity exists in the industry to satisfy local requirements.

MINING PLANT

Some of the leading engineering firms in the Commonwealth came into existence as a result of the demand created by the expanding mining industry. This demand was initially met by imports from overseas.

For some time the METALLIFEROUS MINING INDUSTRY has been well catered for by Australian manufacturers, who are in a position to build machinery for winning, raising and treating all types of ore found in the Commonwealth. Australian machinery has also been exported to mines in Malaya and Nigeria, particularly the former, where replacement of plants damaged or destroyed during the 1939-45 War has resulted in further substantial orders being placed.

The manufacture of COALMINING MACHINERY has not been developed to the same extent as that for metalliferous mining. Coal cutters and loaders have been made by private mining interests, also mining cars and diesel

and battery locomotives, but imports of underground and surface plant have been substantial. During the period 1948 to 1950 coal-cutting machinery to the value of about £320,000 was imported, in addition to the new land-dredger obtained for the Victorian brown-coal field at a cost of about £150,000, and for which an order has been placed. Planned expansion of coal output in Australia over the next few years should provide a growing market for coal winning equipment in both open-cut operations and deep mining. (See Chapter 1.)

ROCK DRILLS are not made in Australia, but one local firm has the capacity to undertake their manufacture. Although one leading overseas firm considered this question, the project was abandoned because of the strong competition between the various manufacturers, the constantly changing, and multiplicity of, types and the relatively small market.

OIL-REFINING PLANT

There are no companies specialising in the manufacture of oil-refining plant in Australia, nevertheless probably at least 90 per cent. of the equipment can be made in this country by a selection of the leading engineering firms. Piping and tanks can be fabricated locally, and essential imports are limited to instrumentation and special parts such as the slide valves for "cat-crackers". The serious shortages of labour, and of steel, have until

recently forced oil companies to import a high proportion of the plant required. No statistics of these imports are available. The future Australian market for oil-refining equipment can be judged from the programme of four leading overseas companies to erect refineries during the next five years, with a capacity of six million tons at a total cost of more than £81 million (see Chapter 1).

OFFICE AND SHOP EQUIPMENT

Practically all of Australia's requirements of OFFICE MACHINES AND APPLIANCES, particularly the more intricate types such as adding machines, cash registers, dictating machines, duplicating machines and typewriters, are imported. As the market for these

machines is limited, it is doubtful if any manufacture of them in Australia would be economical. The manufacture of typewriters has been investigated but has not been proceeded with for this reason. Imports of office machines in 1949-50 and 1950-51 were—

IMPORTS:

	1949-50		1950-51	
	no.	£	no.	£
Adding and computing machines	16,347	1,056,652	28,282	1,854,300
Cash registers	6,070	544,434	5,422	560,328
Dictating machines and blank record cylinders, etc.	—	67,252	—	146,745
Duplicating machines	—	68,665	—	98,467
Typewriters	17,350	530,922	21,730	772,303
Parts of typewriters	—	27,610	—	32,179
Pencil sharpeners (rotary)	10,334	7,045	13,377	9,407
Office and accounting machinery, n.e.l.	—	334,873	—	420,082

Metal OFFICE AND SHOP FITTINGS are made either from bronze or steel, the latter being nickel or chrome plated. The majority of the firms engaged in manufacture operate their own electroplating plants. The demand for display fittings depends largely upon activity in the retail trading field. Until recently, the demand has been constant, but with the recent drop in retail trading, particularly in the textile field, demand has fallen considerably.

The manufacture of HAIR WAVING AND DRYING MACHINES and equipment of the non-electric and machineless type is well catered for in Australia. There is, however, no manufacture of hair clippers, hand or power operated. Beauty aid machines including most types of massage apparatus are also imported. Total imports of these items, including certain types of waving machines and hand-driers, were valued at £256,752 in 1949-50 and at £276,426 in 1950-51.

OPHTHALMIC AND OPTICAL GOODS PLANT

No statistics are available relating to production, imports or exports of ophthalmic and optical goods plant. A range of plant is made in Australia, including edging, surfacing and polishing machines, grinding and polishing

laps, lens measures, etc. Most of this plant is made by precision-engineering establishments, often to special order. Some specialised plant is imported.

PAINT AND PRINTING-INK PLANT

Since there are only about twelve makers of printing ink in Australia, the market for this type of machinery is relatively limited. Printing-ink machinery is generally similar to that used for paint making, and includes roller mills and mixers. About 80 per cent. of printing-ink machinery in use in Australia

is of local manufacture. Australian machinery, which is locally designed, is regarded as equal to the imported article. The only items in this category which are imported are a few special machines such as automatic can-filling machines and single-roll mills.

PAPERWORKING AND PRINTING PLANT

The extent of manufacture of paper-working machinery in Australia is increasing steadily as the converting industry becomes more accustomed to buying Australian-made machinery. Some engineering establishments making paper-working machinery have become specialists, and at least one of the principal manufacturers is now operating also as the Australian agent and installation engineer for one of the leading U.K. makers of paper-working machinery. Items of printing-trades machinery are also made by several of the manufacturers of paper-working machinery.

Principal among paper-working machines being made, occasionally to stock, but mainly to order, are sheeters, slitters and rewinders, cardboard slitters; pasters for solid-fibre container board; machines for sheet varnishing or waxing; embossing, crepeing, creasing machines; envelope machines; paper-tag machines; exercise-book and writing-pad machines; tagmakers; paper-cutting guillotines (see also Printing-trade Machinery, following); cardboard-box machinery, such as slitters, rotary cutter-and-scorers; tubemaking machines. The value of output of paper-working machinery is not specified in official production statistics.

The value of imports of paperworking machinery (including carton-making machinery, but not bookbinding and bookmaking machinery), over recent years, was as follows: 1946-47, £121,200; 1947-48, £284,900; 1948-49, £373,500; 1949-50, £483,030. The value of Australian-made paper-working machinery exported is not specifically recorded, but is understood to be small.

Manufacture of CARDBOARD-BOX MACHINERY is now well established in Australia, but CARTON-MAKING MACHINERY, such as carton rotary cutter-and-scorers, carton-cutting presses, automatic folders-and-glueers, are practically all imported; a few

machines have been made to specific order, many being copies of an imported machine. The demand for cardboard cartons and boxes and fibreboard containers is increasing, which encourages the renewing and extension of plant.

The manufacture in Australia of printing-trades machinery cannot be considered to be strongly established except for certain items of machinery and equipment in relatively large demand. The value of output of "Printing machinery" made in Australia in 1949-50 was £319,800; it is not clear as to what is the extent of coverage of the item, but it probably includes most, if not all, types of paper-working equipment that are made in Australia.

COMPOSING EQUIPMENT, such as compositors' trimmer-saws (bench type), slug cutters and miterers, pica-gauges, type-high gauges, composing-sticks and chases, are being made to increasing extent and satisfactory quality (also printers' woodware, type-cases, etc.), but all such items are also being imported. Imposing surfaces, metal furniture, quoins, foundry type (this item is made to limited extent by one manufacturer in Australia), are practically all imported. Composing machines, sorts-casters, strip-casters, and numbering "boxes" are not made in Australia. The value of 1949-50 imports of composing machines, sorts-casters, etc., was £418,000, and of type, metal furniture, quotations, circles, clumps, etc., £24,770.

STEREOTYPING EQUIPMENT is made to a minor but growing extent. Items made include casting boxes, back planer, edge planers, hydraulic matrix-presses, melt-furnaces (including pig-metal casting furnaces). Imports in 1949-50 of all types of stereotyping equipment and electrotyping equipment were valued at £12,640.

ELECTROTYPING BATHS and associated equipment are made in Australia.

PRINTING PRESSES, except in one instance, are usually made to specific order in Australia; in this way quite a range of presses have been made, including a high-speed rotary newspress (with imported cylinders), a web-fed flatbed perfecting magazine-press, offset tinplate-printers, multicolour dry-offset presses, analine printers, tag printers, roll-ticket printers. An earnest effort was made to establish in continuous manufacture an automatic letterpress flatbed/cylinder 13-in. x 20-in. press, of which several are now in satisfactory use. Proof presses of several sizes are being made for stock; a register press for blockmakers is also being made. Imports of printing presses in 1949-50 were 355 platens, £111,950; sheet-fed letterpress flat/bed cylinder, 188 presses, £378,526; sheet-fed offset, 101 presses, £122,010; web-fed presses of any type, 15 presses, £226,780; other types of presses, including proof presses, 322 presses, £167,970. The value of printing-press spare parts imported in 1949-50 was £290,600. Printing presses imported into Australia in the post-war years were mainly imported from the United Kingdom, but in pre-war years the U.S.A. and Germany were major suppliers. Imports from Germany increased to significant levels, but American printing-trades machinery is largely blocked by unavailability of dollars for purchase of such machinery. A very wide range of types and sizes of presses are in use, mainly letterpress, with offset-lithography steadily extending and rotogravure in use for several national magazines.

BINDERY MACHINERY and EQUIPMENT are made to minor extent in Australia. Principal items made in quantity are small folders and label gummers (both hand-fed), hand-operated book-backing presses, hydraulic book-presses, nipping pressers, paper drills, gatherer-stitcher (with imported stitcher-heads) and various small items of bindery equipment are made from time to time. Several makes of hand-operated guillotines, and of powered auto-clamp guillotines in sizes up to 48 inches have been made as stock lines; one or two of the makes may persist as a continuing item of production in Australia. Imports of guillotines in 1949-50 numbered 162, valued at £96,670; 124 of the machines came from the U.K. Imports of bindery machinery otherwise, in 1949-50, were valued at £110,000.

With one notable exception, there is only a limited range of **PHOTO-ENGRAVING and LITHOGRAPHIC - PLATEMAKING EQUIPMENT** made in Australia. A multiplate photo-composing machine, invented and manufactured in Australia, is being manufactured by the Vickers group in the United Kingdom, under licence, for world sales. Several of these machines are in use in Australia, including two 4-plate 60-in. by 40-in. (image centres). Apart from this machine, only small items and mechanical equipment such as rotary graubers, glass graining marbles, etc., are made in Australia.

Imports of printing-trades machinery vary considerably from year to year.

PLASTICS-PRODUCTS PLANT

The manufacture of machinery for the production of plastics products is, in the main, confined to certain types of compression presses (vertical and horizontal), extension presses, preheaters, mixers and similar items. There are about twelve engineering firms which manufacture, in conjunction with other activities, presses of various types for the plas-

tics trade. Certain types of presses are imported, but Australian manufacturers generally are capable of satisfying most requirements. The manufacture of injection-moulding machines (up to 8-oz.) was recently commenced; previously all such machines were imported, although a few plastics manufacturers had built machines for their own use.

PULP, PAPER AND PAPERBOARD PLANT

During 1949-50 papermaking machinery to the value of £425,120 was imported, mainly from Canada and the United Kingdom. Paper-making machinery may be divided into four groups, namely—pulp plant; plant used for the recovery of chemicals where the chemical process is used; paper and paperboard machines; auxiliary machines such as rewinders, cutters, slitters, etc. Manufacture of some paper making machinery is already carried out

in Australia and, although output is at present small it is increasing. Machinery produced in Australia includes drying cylinders, limekilns, evaporators, digestors, stock washers, concentrators, vats and moulds. (The value of plant in paper and paperboard mills in Australia at 1949-50 was £5.75 million.) Expansion plans of the paper industry will require considerable quantities of papermaking machinery.

RUBBER-PRODUCTS PLANT

Most items of rubber-products plant are made to order by the larger engineering companies. No statistics of Australian production are available. Imported machinery was valued

at £50,498 in 1949-50 and at £21,461 in 1950-51. Australian industry has proved itself capable of making practically all plant required by the rubber-products industry.

SMELTING AND REFINING PLANT

The manufacture and fabrication of mineral-treatment plant comprises a part of the activities of a number of heavy engineering establishments in Australia. An electrical firm has specialised in making magnetic separators. Most smelting and roasting machinery is erected on site, sometimes with the assis-

tance of overseas consultants. This includes blast furnaces. Some blast equipment is imported. The large metal-refining companies themselves employ extensive engineering and design staffs. Considerable expansion is taking place in mining and in mineral treatment in Australia, particularly in non-ferrous metal

smelting and refining (see Chapter 9) and in coal processing (see Chapter 1). Such expansion is likely to lead to increasing demands for mineral-treatment and metal smelting and refining plant, even though some large items

are being imported. The value of imports of smelting, leaching and metal-refining appliances in 1949-50 was £85,675 and in 1950-51 was £232,541.

SOAP AND WASHING-POWDER PLANT

Probably less than half the demand for soap machinery is supplied by local manufacturers; most machines are imported from the United Kingdom. Soap kettles are comparatively simple and, like most of the auxiliary equipment, are made in Australia. The principal machines required by the soap industry which must be imported are patent plodders and large automatic wrapping machines. The market for soap machinery is affected by the

peculiar organisation of the soap-making industry, in which there are nearly one hundred firms dominated by two large overseas combines. The small output of most Australian soap makers does not justify the installation of extensive plant. Import statistics show soap-making and candle-making machines combined, the figures for 1949-50 being nine machines, valued at £18,548 and for 1950-51, eight machines, valued at £10,242.

TANNING AND LEATHER-WORKING PLANT

Australian manufacturers make a range of tanning and leather-working machines, and supply practically all requirements of the Australian market. There are no statistics avail-

able to show value or quantity of production. Imports of tanning and leather-working machines in 1949-50 were valued at £42,290 and in 1950-51 at £61,218.

TEXTILE PLANT, INCLUDING FIBRE-PROCESSING PLANT

In 1949-50 TEXTILE MACHINERY valued at £775,420 was produced in Australia. Circular and flat knitting machines, wool-scouring, carbonising and dyeing equipment, and other plant and equipment were included in this amount. Until recently there has been a tendency to concentrate on the manufacture of items presenting no major technical problems in their manufacture. Imports of textile machinery for 1949-50 reached a total of £5,470,000. Demand has shown a marked decline in 1952.

CARD CLOTHING manufacture in Australia is undertaken by one company which receives a portion of its raw materials from its

parent company in the United Kingdom. The textile industries in Australia have not been fully catered for by this company; in 1949-50 imports were valued at £63,441.

COMB CIRCLES, FALLERS, TEMPLE RINGS AND TENTER GILLS are made in Australia by one company, which proposes also to make porcupines and gill screws. The company also conducts a repair service on textile accessories for the textile industry. One other company is engaged upon repairing of textile accessories, but does not manufacture new parts. Imports for 1949-50 of accessories for carding and combing machines, including comb circles, etc., were valued at £74,670.

TOBACCO-PROCESSING PLANT

Machinery for the tobacco industry has not as yet been made in Australia except for occasional items produced to specific orders. With a possible expansion of tobacco cultivation there is a tendency to explore this field

a little more fully, and at least one firm is preparing to produce certain tobacco-processing machinery, for which it hopes to arrange suitable licence agreements with overseas manufacturers.

WOODWORKING PLANT

The production of woodworking machinery in Australia covers a wide variety of types and sizes of general-purpose machinery built both to standard designs and to meet special requirements. The industry also caters for the greater part of the requirements of the saw mills. Machines manufactured include circular and hand saws, lathes, sanders, planers and thicknessers, shapers and spindle-moulders, tenoning, morticing and other specialised machinery for the furniture and

cabinet-making trade, veneer peeling and slicing machines, glueing machines and presses for the plywood industry.

Although manufacture is expanding rapidly, as indicated by total outputs of £687,228 and £893,018 in 1948-49 and 1949-50 respectively, about one-third of requirements—£476,170 in 1949-50—is still imported. However, the types imported are confined mainly to very specialised equipment in the high-priced field.

PLANT OF A GENERAL NATURE

AIR-CONDITIONING PLANT

The air-conditioning industry owes much of its initial growth to the establishment by two overseas organisations of branches in this country, but the most rapid expansion

has taken place fairly recently, largely as a result of war-time demands. The natural alliance with the refrigeration industry, in which industry many manufacturers extend their

activities to include air-conditioning plant, has also resulted in a certain amount of parallel developments. Future trends are not readily discernible, but expansion in industries requiring controlled atmospheric conditions as an essential adjunct to particular processes (e.g., textiles), the increasing attention being paid to air conditioning as a means of improving

working conditions, and the possible demands from the commercial field when the easing of restrictions permits new building, all suggest that a considerable increase in requirements may develop. The ability of existing facilities to meet these latent demands cannot be accurately assessed.

AIR-COMPRESSING PLANT AND PNEUMATIC TOOLS

The manufacture of compressors and vacuum pumps has been well established in Australia for some years, and about twenty-six firms are producing reciprocating equipment of various types and sizes. Rotary compressors do not appear to be made in Australia, but some have been imported. TURBO-COMPRESSORS and BLOWERS of large capacity are also imported, but the demand is limited and local manufacture has not, to date, been considered an economic proposition. Special-purpose compressors working in the 4,000 to 5,000 p.s.i. range or higher are not made in Australia, and the present demand is so small and uncertain that it would be difficult to justify their manufacture. With these exceptions the market appears to be well catered for. Eight large firms specialise in the manufacture of piston compressors in the range 100 to 3,500 c.f.m. and 30-100 lb. pressure. It is possible that one or more of these firms could build up to 5,000 c.f.m. if necessary.

The demand for PNEUMATIC TOOLS for constructional, mining and general industrial use is fairly constant, and can be expected to continue. Replacement of wearing parts is particularly high and recent years have seen a growth of manufacture of these parts by companies which previously had no connection with the manufacture of pneumatic equipment. There is an extensive demand for replacement parts from mining areas particularly. The two major organisations in this field have found that manufacture in Australia of the heavy-duty pneumatic tools is not economic, and have continued to import the motor unit from overseas. The largest items of this type of equipment in demand are rock drills and rock-boring units. Imports in 1949-50 and 1950-51 were valued at: Rock drills (rotary and percussive) £285,197 and £438,399 respectively; and rock-boring units £226,737 and £210,603 respectively.

CRUSHING AND PULVERISING PLANT

The manufacture of crushing and pulverising plant in Australia is carried out by many of the larger, well-established general engineering companies which manufacture mining machinery, as well as by several smaller firms which produce items for the chemical, food and other industries. Although a considerable amount of activity in this field is at present directed to the fabrication of replacement parts for existing plant, new equipment is manufactured to meet specific orders. In 1949-50 the total value of stone crushing

machinery produced was £185,703. Types of machinery produced include jaw and cone crushers; hammer, stamp, ball, pebble, rod and other types of milling equipment and various types of pulverisers. Recent requirements of heavy primary crushers have been obtained from overseas. Fifteen crushers were imported in 1949-50 at a cost of £25,380. This was probably due to shortages of raw materials, rather than to any lack of capacity in the industry.

CUTLERY AND SAWS

Products in the cutlery group being manufactured in Australia include knives of all types, industrial and domestic; scissors, shears and snips; and razor blades. (The manufacture of spoons and forks and similar items is treated under "Plated Ware", earlier in this Part.) Australian production of household knives in 1949-50 totalled 40,756 dozen, valued at £70,732; and of guillotine and wood-working knives, 12,457 dozen, valued at £139,708. No information is published as to the quantity of razor blades produced by the one manufacturer of razor blades in Australia. Imports of cutlery, including razor blades, amounted to £1,787,140 in 1949-50, chiefly from the United Kingdom. There is a marked preference for cutlery of British manufacture,

and manufacturers in Australia face severe competition from this source.

Production of SAWS in Australia includes hand saws, circular saws, band saws and metal-cutting saws. In 1948-49 and 1950-51 the value of saws produced was—

PRODUCTION:	1948-49	1950-51
	£	£
Circular saws	207,136	360,943
Hand saws	8,099	35,525
Band saws	28,615	86,519 (a)
Metal-cutting saws	26,776	

(a) All other saws.

Although the local manufacturers are well established in this field, considerable quantities of saws and saw blades are also imported. Imports in 1949-50 and 1950-51 were—

	1949-50		1950-51	
	doz.	£	doz.	£
Hand saws, including hack saws, cross-cut saws, etc.	53,651	273,847	106,279	306,019
High-speed steel hack-saw blades	116,893	37,289	198,860	79,372
Other hack-saw blades	391,065	89,878	286,059	54,920
Other hand-saw blades	—	16,316	—	21,062
Hack-saw material and blading for the production of hand saws	—	7,280	—	9,328
Saw blades for machine saws, except hack-saw blades—				
Band saws	—	30,604	—	18,139
Circular saws	—	65,954	—	65,980
Saw blades for machine saws, n.e.i., and saw material for production of machine-saw blades	—	28,911	—	66,809

Power hacksaw blades are not made in Australia, but an Australian subsidiary company

of Paul Beck (England) Ltd., U.K., expects to begin production of such blades by late 1952.

ENGINES

Production of STATIONARY DIESEL-ENGINES up to 75 h.p. is well established in Australia, and sufficient capacity exists for the manufacture of the smaller PETROL and KEROSENE ENGINES to satisfy requirements. A limited number of engines of over 75 h.p. are manufactured, including diesel engines for marine purposes but, broadly speaking, the bulk of requirements over 40 h.p. are at present being imported. Heavy imports of engines below 40 h.p. and reduced local demand hit the industry in 1952. Value of output for all engines (exclusive of automotive engines—see Chapter 10) for 1949-50 amounted to about £2.5 million. The bulk of this is diesel and petrol

engines, marine and stationary types, under 6 h.p., which accounted for slightly less than half the total value and about 70 per cent. in quantity. Recent expansion in the manufacture of earth-moving equipment has drawn attention to the necessity for importing suitable prime-movers. It appears likely that higher-powered diesel engines will be in strong demand, also for power generating, shipbuilding and the heavy transport industries. A leading United Kingdom company is establishing a plant in Australia initially for assembling and servicing automotive diesels, and will progressively increase the use of Australian-made components.

FANS AND BLOWERS

The manufacture of industrial fans and blowers also appears to be well covered, there being at least twenty firms engaged in the

manufacture of all types to meet demands for air conditioning equipment, mine ventilation, mill exhaust and similar systems.

FIRE-PROTECTION EQUIPMENT

With at least thirteen firms engaged in the manufacture of some form of fire-protection equipment, the industry has sufficient capacity to meet the demand. Shortages are experienced at times, due to the difficulties of ob-

taining skilled labour, iron piping, iron, and certain fittings which sometimes have to be imported. Imports of fire extinguishers, mostly from the United Kingdom, rose from £56,488 in 1948-49 to £75,160 in 1949-50.

FIXTURES, SHELVES, FURNITURE OF METAL

Metal furniture manufactured in Australia includes tubular steel furniture for office, factory and domestic use; steel filing cabinets, cupboards, benches, etc.; steel storage racks and similar equipment; and (in one instance), domestic furniture such as bedroom suites. Total value of output of metal furniture for

1949-50 amounted to £2,253,228. This branch of industry, together with general sheetmetal working and steel fabrication, is suffering from the common disability of shortages in supply of raw materials. In each case, capacity is considered to be adequate to demand.

FURNACES AND OVENS

INDUSTRIAL FURNACES and OVENS (see also "Electric Furnaces", Chapter 11) manufactured in Australia cover a wide range of electric, gas and oil-fired equipment, the majority of which is built to specific requirements, although some lines have been standardised. The types manufactured include furnaces and ovens for melting, carburising, annealing, hardening, enamelling, etc. The industry possesses wide technical experience

and produces equipment of a high standard. Included in the manufacturers are well-known overseas companies which have either established branches in Australia or arranged with established concerns to manufacture their special equipment under license. Demands on the industry are heavy and, since most of the equipment is built to order, delays are unavoidable.

HANDTOOLS

About 140 factories in Australia are engaged in the manufacture of cutlery and small handtools. Total value of output for 1949-50 amounted to £3,773,000. For statistical purposes the industry covers cutlery (including razor blades), spoons and forks, and small handtools.

The manufacture of small handtools includes a wide range of gardening, carpenters' and engineers' tools. In general, the quality of the tools manufactured is of a high

standard, but there continues to exist a preference in the Australian market for certain well-known brands of overseas manufacture. The industry has to withstand severe competition from imported tools despite, in many instances, a substantial difference in price. Recent additions to tools manufactured locally are carpenters' chisels and bits, which are being produced by a subsidiary of The Broken Hill Pty. Co. Ltd. (See Chapter 11, for portable electric tools.)

HARDWARE NOT ELSEWHERE INCLUDED

Output of hardware in Australia at present is sufficient to meet requirements, and to permit some exports. In the early post-war

years, however, production was lower, and considerable imports were necessary to meet the demand. No statistics are available of actual

Australian production; however, the following estimates for 1948-49, based on production figures of major manufacturers, gives an indi-

cation of the order of production of builders' hardware—

PRODUCTION AND DEMAND ESTIMATES, 1948-49:

	Estimated Annual Production	Estimated Annual Demand
	pairs	pairs
Hinges—		
Up to 4 inch butts and cabinet offsets ...	9,000,000	7,234,500
Other, including butterfly spring catches ...	300,000	328,600
	units	units
Small barrel bolts ...	1,700,000	1,370,000
Kitchen-cabinet catches ...	2,700,000	2,752,000
Hat and coat hooks ...	4,700,000	2,450,000
Drawer pulls (including handles) ...	2,700,000	2,044,000
Mortice locksets (including latches rebated and rim locks) ...	2,151,000	2,013,000
Night latches (with or without furniture) ...	207,000	173,000
Screen-door catches ...	500,000	328,000
Casement stays and fasteners (including combines and separate patterns) ...	1,000,000	1,150,000
Cupboard catches (includes some mortice latches) ...	1,200,000	1,008,000
Sash lifts ...	5,000,000	2,254,000
Sash fasteners ...	2,400,000	1,127,000
	sets	sets
Sets of sash balances (including patent patterns) ...	1,300,000	1,127,000

As stated above, production has increased recently, and current output would now be somewhat higher than is shown in the above table—production of hinges has doubled.

Normally, only a few lines of builders' hardware, usually of high-grade types, are imported into Australia. Value of imports of hinges, bolts and locks for prewar and recent years was—

IMPORTS:	1938-39	1949-50	1950-51
	£	£	£
Hinges ...	17,491	56,503	123,269
Locks and locksets ...	72,100	141,897	174,908
Barrel and socket bolts ...	—	417	501

The principal source of these imports was the United Kingdom. All imports are now subject to licence—see Appendix II.

Pre-war, about 30 per cent. of Australian production of builders' hardware was exported. However, to ensure reasonable supplies to meet the Australian demand, particularly for housing requirements, export restrictions have been imposed by the Commonwealth Govern-

ment. Some lines are subject to export quotas amounting to from 10 per cent. to 25 per cent. of their production, and others are free from control. Recently, control over exports has been suspended. Owing to restrictions placed on imports by the South African and New Zealand Governments, our markets in those countries have dwindled until Australian manufacturers generally have lost interest. It is hoped that some easing of these restrictions in the future will revive Australian exports to those markets.

Hinges, locks and locksets and barrel and socket bolts only are recorded distinctively in official statistics. Australian exports of these items in 1949-50 and 1950-51 were—

EXPORTS:	1949-50	1950-51
	£	£
Hinges ...	18,257	25,081
Locks and sockets ...	64,635	68,023
Barrel and socket bolts ...	2,041	1,563

The principal countries to which these exports were sent included India, Malaya, New Zealand, South Africa and Australian Territories.

LUBRICATING EQUIPMENT

Lubrication equipment in a wide range of oil pumps, grease guns, oil cans, etc., is being produced by a well-established firm in South Australia, and, since the demand for such

items is being met no reason for immediate expansion is apparent. The industry appears capable of meeting the existing demand.

MOVING, HANDLING AND HAULING PLANT (OTHER THAN PRIMARILY TRANSPORT EQUIPMENT AND CONSTRUCTION PLANT)

With certain exceptions the field of materials-handling machinery appears fairly well covered.

CONVEYORS are manufactured by many leading firms to suit a variety of requirements, such as mining, flour mills, power houses (coal and ash handling) and general industrial work. Bucket and chain conveyor-elevators have been installed in many situations. Total value of conveyors and appliances produced in 1948-49 was £391,810, and in 1949-50, £361,532.

ELEVATORS for general purpose are made by at least twenty firms in Australia, and capacity would appear to be ample except that certain types, for instance the "Redler", are not made. Reported performance of these units suggests that, once popularised, their production would be a profitable enterprise.

Passenger and goods LIFTS, both electric and hydraulic, are made by a number of firms whose activities have been restricted by controls on building. A return to normal conditions would result in greatly increased demands. ESCALATORS have been manufactured to specific orders.

CRANES of many types, including travelling, cantilever, jib, floating, and other types, have been built in Australia for many years. Under normal conditions, manufacturers have sufficient capacity to supply requirements of all but the larger cranes. This field is amply catered for by the various concerns which specialise in this branch of the engineering industry. The total production of hoists, cranes and lifting machinery was valued at £705,337 in 1948-49, and at £1,110,201 in 1949-50.

MOBILE INDUSTRIAL-TRUCKS are made in Australia, but the very large types are still imported. Types manufactured include battery-, diesel- or petrol-operated fork-lift and platform trucks, which are of high quality. Manufacture in Australia has expanded recently, and a number of firms have entered this field. At least two well-known brands of American equipment are made in Australia under licence.

There are several manufacturers of hand, electric and hydraulic STACKING EQUIPMENT.

In view of the anticipated expansion of secondary industry and an increasing appreciation of the advantages of efficient methods there are possibilities of additional opportunities in the field of materials-handling equipment.

The trend towards farm mechanisation (stimulated by the recent labour shortage and higher farm incomes) and the implementation of developmental projects involving the use of heavy earthmoving equipment maintained the demand for tractors of all types at high levels after the 1939-45 War. As a result, production of tractors assumed increasing importance.

The manufacture of tractors, apart from rotary hoes, is confined at present to WHEELED TRACTORS in the 33 to 41 and the 100 to 180 maximum drawbar h.p. ranges.

The absence of any local production of CRAWLER TRACTORS has proved a handicap to constructional projects and agricultural development, because of shortages of overseas supplies, particularly from the United States of America. However, several firms in Australia have expressed an interest in this field and have plans at various stages to enter into the manufacture of crawler tractors, but as yet no actual production has commenced. Should production of crawler tractors be commenced, a logical step would be the development of manufacture of automotive diesel engines in Australia.

Four companies have made AGRICULTURAL WHEELED TRACTORS proper, and one company an AGRICULTURAL WHEELED TRACTOR with ROTARY-HOE ATTACHMENTS. One company is producing INDUSTRIAL WHEELED TRACTORS with which is incorporated earthmoving equipment such as scrapers, rock buggies and dozers made by the same organisation. The industry is concentrated mainly in Victoria and New South Wales, with one important company in Western Australia. Costs of production have varied considerably within the industry, and only two companies have, as yet, been able to achieve production of tractors at prices comparable with those of similar imported models.

Because of wartime shortages and buoyant farm incomes in the post-war years, the demand for wheeled tractors has been at very high levels in recent years. However, the large numbers of new tractors going into the field in this period might well mean a lower replacement level of demand within the next few years. Moreover, the demand for wheeled tractors for agricultural use is very susceptible to changes in farm incomes, and a continuation of high levels of demand is subject to the maintenance of farm incomes at or near present levels.

Estimates of current requirement of wheeled tractors vary from 17,000 to 19,500 a year.

Under present circumstances it is considered that the current effective demand is of the order of 18,000 machines a year, which is considerably below the total sales of the past two financial years. The following table sets out the estimated current annual demand as between horsepower groups—

MAXIMUM DRAWBAR HORSEPOWER:	Estimated Current Annual Demand
	Units
6 to 25 h.p.	7,000
Exceeding 25 but not exceeding 40 h.p.	8,000
„ 40 h.p.	3,000
Total	18,000

The large backlog of demand of several years ago has now been eliminated except for some high clearance and very high horsepower models. In fact there are large stocks of wheeled tractors on hand.

Some agricultural-type wheeled tractors are used for industrial purposes, both as general traction units and as basic units for shovel loaders, mobile light cranes and light patrol graders. This demand, which is included in the above estimates, is now at a level of about 1,000 units a year. It is concentrated in the medium (21-35) horsepower class.

The Australian production of wheeled tractors (apart from rotary hoes) until 1948 was negligible. In the year 1948-49 Australian output was about 1,000 machines. Imports in the same year were 17,673 machines, and in 1949-50, 23,985 machines. (This figure includes imports of tractors with very low horsepower ratings.) Production in 1949-50 was 3,920 tractors. These are all in a range of 33-41 maximum drawbar horsepower, i.e., in the medium and heavy horsepower groups. Production in recent months has declined considerably, and one company has stopped making tractors. Current supplies are in excess of the estimated current demand, and the market in Australia for these machines, which is already quite competitive, is likely to become increasingly competitive unless imports are reduced considerably.

The company producing powered rotary hoes manufactures five basic models of tractors and rotary-hoe attachments. The tractor and rotary-hoe attachments are sold as complete units. These are all in the light and medium horsepower ranges.

The industry is now working at about 80 per cent. of plant capacity on a one-shift basis, due mainly to current sales difficulties. Because of the increasingly competitive nature of the Australian market, projected expansion plans of local manufacturers have been postponed indefinitely. The industry is likely to meet continued strong competition from imports (particularly from the United Kingdom), which could affect adversely the long-term levels of output. All imports are now, however, subject to licence—see Appendix II.

The current demand for industrial-type wheeled tractors above 100 h.p. (including dump wagons) is estimated at 130 machines per annum. This demand is particularly susceptible to changes in the level of public works; consequently the demand in the near future might possibly fall below the current level.

Industrial wheeled tractors, mainly two-wheeled units in which are incorporated earthmoving equipment, are made locally by only one company. Output in the year 1948-49 was 66 machines, but recent output has been

at a rate of about 90 machines a year. Present production is confined to machines powered with diesel engines of 100 or 160 h.p. (two-wheeled units), and 180 h.p. (a four-wheeled unit), but experiments are also being carried out on the production of models down to about 60 h.p. The content of local manufacture in the two-wheeled machine is about 70 per cent. of the total cost, and in the four-wheeled machine about 33 per cent. The diesel engines for these tractors are imported from the United States of America.

Recent imports of wheeled tractors have been maintained at high levels and have covered more than adequately the difference between local production and the Australian demand.

The demand for CRAWLER TRACTORS in Australia arises from both agricultural and industrial uses. Over 90 per cent. of the current demand for crawler tractors for agricultural use is for machines of 25 to 50 maximum drawbar h.p. There is also a small demand for crawler tractors from 38 to 50 maximum drawbar h.p. suitable for light clearing and dam sinking. On the other hand, over 80 per cent. of the demand for crawler tractors for industrial use is for machines of over 50 maximum drawbar h.p.

In view of the very different type of market, the demand for crawler tractors for industrial use and the demand for agricultural use is dealt with separately below.

The main industrial uses of crawler tractors are for roadmaking, quarrying, open-cut mining, dam construction and timber-getting. The demand in Australia has developed strongly during the past few years for these purposes from both public and private authorities, although in 1952 there has been some check to demand. It is estimated that there is at present a current demand of 1,000 crawler tractors a year for industrial use, and in addition a small backlog confined mainly to machines in Classes 2 and 3. The following table gives an estimate of the current demand as between horsepower groups—

INDUSTRIAL:	Estimated Current Annual Demand
	Units
Class 1—Over 95 max. drawbar h.p. ..	150
Class 2—70 to 95 " " " "	250
Class 3—55 to 69 " " " "	360
Class 4—38 to 54 " " " "	220
Class 5—Under 36 " " " "	20
Total	1,000

There is at present a preference for the crawler type of tractor over the wheeled type for industrial use, except as a base for shovel

loaders and mobile cranes for which wheeled tractors are generally preferred. This general preference for crawler-type tractors appears likely to be maintained in the immediate future.

Estimates of current requirements of crawler tractors for agricultural use vary from 1,500 to 3,000 machines a year. It is considered, however, that under present circumstances the current effective demand is of the order of 1,500 machines a year. The following table sets out the estimated current annual demand as between horsepower groups—

AGRICULTURAL:	Estimated Current Annual Demand
	Units
Class 1—Over 95 max. drawbar h.p. ..	10
Class 2—70 to 95 " " " "	20
Class 3—55 to 69 " " " "	70
Class 4—38 to 54 " " " "	720
Class 5—Under 36 " " " "	680
Total	1,500

Of course, the demand for crawler tractors for agricultural use is very susceptible to changes in farm incomes. Any significant fall in these incomes might well reduce the demand below these levels.

On the basis of the above estimates, there is at present a total current demand for crawler tractors of about 2,500 machines a year, and in addition a relatively small backlog of demand, confined to the more popular makes. The large backlog, which accumulated over a number of years because of restrictions on imports from the United States of America and a low availability from "soft currency" areas, has been reduced considerably during the past nine months.

Imports of crawler tractors for the years 1946-47 to 1948-49 averaged little more than 1,000 machines a year and were very inadequate for Australian requirements. Although imports, both from "dollar" and "soft currency" areas, increased since then to more than double that level, they have been insufficient in themselves to make any appreciable impression on outstanding orders. Cancellations and deferment of orders have accounted largely for the shrinking backlog of demand. The level of public works particularly influences the demand for crawler tractors.

As the demand for imported REPLACE-MENT PARTS is estimated to be about £3.5 million a year, there may be possibilities for economic manufacture of some of the parts in greatest demand, if licensing and technical difficulties can be overcome.

PACKING-ROOM PLANT (OTHER THAN FOOD PACKAGING)

The manufacture of packaging equipment is closely associated with that of food-processing and allied machinery, and many firms in the latter field also produce packaging machines in connection with their normal product, while there are others who specialise in particular lines. Manufactures include such machines as capping, bottle filling and sealing, filling machines for collapsible tubes, tins and jars, labelling, gumming, nailing and strapping machines. The manufacture of packaging equipment has

shown significant development over the last few years, and has been assisted through the licensing of Australian firms to manufacture to overseas designs. Most of the manual, semi-automatic and simpler automatic packaging machines are made in Australia, but the complex, completely automatic machines must still be obtained from overseas. Imports of packaging machinery were valued at £355,266 in 1948-49, and in 1949-50 at £326,276, and came mainly from the United Kingdom and the United States of America.

POWER-TRANSMISSION EQUIPMENT, INCLUDING BEARINGS

A comprehensive range of power-transmission equipment is manufactured in Australia, including variable-speed drives, reduction units, and various types of gearing, clutches and plain bearings. Ball-bearings are made in limited ranges, while roller bearings are not made at all; neither are in plentiful supply. Belting of all types is used, but manufacture is confined to leather and rubber, while hair, cotton and balata are imported. Roller chain

in larger sizes has been made in Australia for many years, and production is sufficient to meet most requirements. The manufacture of small pitch roller chain has only recently been commenced, and output is going solely to the manufacture of agricultural implements; all requirements for power transmission must still be imported. Total imports of roller and inverted tooth chain in 1949-50 were 19,292 cwt., valued at £502,406.

PUMPS

There are numerous firms throughout Australia engaged in the manufacture of pumps, and the industry is well established. The value of output in 1949-50 amounted to £2.17 million. Types produced include reciprocating, centrifugal (both single and multistage), rotary, hydraulic, diaphragm, boiler-feed and special-purpose pumps to meet the needs of particular industries. The sizes and capacities of pumps produced are many and varied

and the industry is capable of meeting practically all requirements. Imports for 1949-50 totalled £305,341—an increase of about £50,000 over the previous twelve months. Experience shows that Australian-made pumps compare favourably in design and performance with the best obtainable from overseas and certain types, such as gravel and sand pumps, have been made and exported to Malaya, Borneo, Nigeria and even to the United Kingdom.

REFRIGERATION PLANT

The manufacture of REFRIGERATION EQUIPMENT has been well established in Australia for many years and covers the entire field, including domestic refrigerators. (For electric refrigerators, see also Chapter 11.)

Australian production of DOMESTIC REFRIGERATORS in the year 1949-50 was 162,300 units, and in 1950-51 203,000. Imports for the year 1949-50 were 22,326 units, and in 1950-51, 19,606 units. Production in the first ten months of 1951-52 was 169,780 units. In the latter months of this period output fell sharply. There has, in the past few years, been a very big backlog of demand for domestic refrigerators, but demand has fallen considerably lately, and local capacity is well in excess of demand.

There are several firms engaged in the manufacture of INDUSTRIAL REFRIGERATION EQUIPMENT. These firms are mainly large and well established, and produce most of their own component parts. The majority of these firms manufacture both high-pressure and low-pressure refrigeration equipment, including a wide range of units suitable for commercial establishments. The majority of domestic refrigerator manufacturers, plus a large number of other firms which may generally be regarded as assemblers, manufacture a wide range of refrigeration units for commercial usage.

Apart from the producers of complete units, there are many other firms specialising in the manufacture of REFRIGERATION COMPONENTS, such as, cabinets, compressors, condensers and condensing units, evaporators, trays, valves and similar items. Quite frequently, manufacturers of cabinets and condensing units also assemble other domestic or commercial refrigeration units, or both, while manufacturers of other components are not engaged in the manufacture of any other refrigeration equipment.

Several of the major manufacturers have overseas connections, and thus keep abreast of latest developments, and have access to the results of research undertaken by their overseas affiliations. The equipment produced is generally modern in design, and compares more than favourably with world standards.

Any increase in the activities of the refrigeration industry will be reflected in a larger demand for CONTROL EQUIPMENT. The only items of local manufacture are thermostat and thermostatic expansion valves to suit small refrigeration units, and these only in partial satisfaction of demand. The remaining equipment is imported, a considerable portion from America. Some attempt is now being made to increase local manufacture, but the deficiency is far from being completely met.

SCREENING PLANT

The manufacture of screening plant is undertaken, in most cases, in conjunction with that of crushing and pulverising plant. A number of the larger general-engineering companies make screening plant (trommel, shaking, vibratory, sifting, etc.) for various

industries—mining, food processing, chemical, etc. Perforated plate or sheet metal, however, is mainly made by one manufacturer. No specific statistics of Australian production, imports or exports of screening plant are available.

STEAM-RAISING PLANT

The manufacture of boilers and steam engines in Australia meets practically all of the local market requirements, although a substantial quantity of parts, particularly of

high-pressure boilers suitable for power-plant installation, is imported. Boilers for ships are also made in Australia (see "Shipbuilding", Chapter 10). Most of Australia's requirements

of TURBINES for electric-power plant (turbines for marine engines are considered in Chapter 10) are imported into Australia. In 1949-50, there were 224 water-tube boilers, valued at £164,450, made in Australia, and 244 other boilers, valued at £211,027. Imports of boilers, steam engines and turbines in 1949-50 and 1950-51 were—

IMPORTS:	1949-50		1950-51	
	no.	£	no.	£
Power boilers and parts thereof—				
Water-tube boilers	2	68	9	33,570
Boilers, other types	—	—	4	9,216
Parts of boilers—				
Corrugated cylinders for boilers	—	110	—	1,256

Parts of water-tube boilers, n.e.i.	—	423,694	—	402,406
Parts of boilers (except water-tube), n.e.i. . . .	—	52,099	—	163,403
Power gas producers ..	—	971	—	10,338
Steam engines and parts—				
Steam engines	6	13,442	41	93,182
Parts of steam engines, n.e.i.	—	65,277	—	45,421
Turbines and parts thereof—				
Steam turbines	5	139,005	12	42,327
Water turbines	6	18,908	5	2,648
Other turbines (including gas turbines)	8	4,477	2	1,244
Parts of turbines—				
Parts of steam turbines	—	714,514	—	1,435,168
Parts of water turbines	—	57,297	—	66,505
Parts of other turbines	—	53,811	—	460,445

VALVES

There are about forty manufacturers of valves, including steam-line equipment, in Australia. Three of these manufacturers specialise in high-class valves. Some of the larger engineering firms which manufacture pumps, boilers, etc., make their own valve requirements, particularly where operating conditions are severe. No separate production statistics for valves are available, but total Australian

output of steam, gas and water fittings, non-ferrous, including valves and parts, for 1949-50, was valued at slightly over £3 million.

Generally speaking, capacity for valve manufacture is sufficient for current demand, except perhaps for certain special types. Production of sizes and types in regular demand at least, is catering for requirements.

WATER METERS

Local manufacture of water meters is not capable of satisfying the Australian demand. Imports of meters are not specifically recorded for statistical purposes, but large quantities are known to be imported. The total Australian output in 1949-50 was 48,000 units, the approximate output value being £250,000. De-

mand is increasing, and an output of 50,000 to 60,000 units is forecast for the period 1950-51. There are four manufacturers of water meters in active production at present, and the tendency is to limit the number of types with a view to standardisation.

WEIGHING PLANT (OTHER THAN SHOP SCALES)

Australian production of weighing plant of all types in 1948-49 was valued at £275,254 and in 1949-50 at £276,338. This production covered a range of types of weighing plant including weighbridges; platforms; counting,

counter, floor and other types of scales, etc. The value of imports of weighing plant in 1949-50 was £172,340 and in 1950-51 was £287,491.

EQUIPMENT NOT ELSEWHERE INCLUDED, PARTICULARLY FOR PROFESSIONAL, TECHNICAL, SOCIAL, DOMESTIC AND PERSONAL USE

CLOCKS AND WATCHES

In the early years after the 1939-45 War a few companies entered in CLOCK manufacture because of the huge demand that had accumulated throughout the war. A sheet-metal-products manufacturer began large production of a utility-type domestic alarm-clock, but ceased making the clock soon afterwards. Domestic electric clocks were made by a few manufacturers, one or two of which produced a considerable number, but all those manufacturers vacated the field when imports began to flow in. (One entered into the manufacture of, among other products, good-quality miniature locomotives, clockwork and electric, and rolling stock.) An attempt to make spring-driven striking/chiming clock movements did not go beyond partial tooling.

Domestic clock manufacture in Australia became firmly established in the later post-war period when an associate company of one of the world's largest manufacturers of domestic alarm clocks and electric clocks and of non-

jewelled pocket watches settled into steady production of utility-type alarm clocks. It later entered into electric-clock manufacture and it is now tooling to make a high-grade boudoir-type alarm-clock. Within a few years it hopes to make the overseas company's NON-JEWELLED POCKET WATCH of widespread repute. Such watches have not been made in Australia. The company considers that its capacity is adequate to meet the demand for clocks of the type made by it, which are in strong competition from imported clocks of the same type.

The value of clocks made in Australia is not specifically published in official statistics.

Imports of clocks in 1949-50 were as follows: Clocks, partly or wholly of wood, 8,100 valued at £15,690; other clocks of domestic type, cased, 503,770 valued at £449,710; clock movements, 65,702 valued at £120,610. The movements are cased in Australian-made cases.

Manufacture of specific-purpose TIMEKEEPING and TIMEKEEPING RECORDING EQUIPMENT, electric or weight-driven, has been firmly established in Australia for many years; capacity is expanding with every opportunity. Master-and-slave clock systems (both frequency and pendulum control), process-timers, chart recorder of water-levels and machine operating-periods, etc., and programme-clocks operating signals such as bells, sirens, whistles, etc., are made in Australia; also public timekeeping equipment such as turret clocks with striking/chiming equipment (all tuned bells for chimes are imported) and, when required, automata. (Turret-clocks are large clocks installed in towers, on elevated signs, and on the sides of buildings. Automata, also known as "jacks", are the assemblage of mechanical figures in association with a public clock such as in an arcade; in simple form an automaton strikes the quarters and hours, but in elaborate form an automaton may operate to represent in dumb play an incident of a well-known legend or story.) Time-card clocks are not made in Australia, but components imported mainly from the United Kingdom are assembled here by a branch of one United Kingdom manufacturer of such clocks and equipment. Imports in 1949-50 of clocks (not of domestic types) were 218 chronometers, valued at £830; 4,056 time registers and detectors, valued at £46,009.

It is generally considered that manufacture of JEWELLED WATCH-MOVEMENTS or assembly of imported components, is impracticable in Australia, not only from the eco-

nomic aspect, but probably also for technical reasons. However, a very high proportion of wrist-watches sold in Australia are cased and banded here in Australian-made CASES and BANDS, the quality of which is recognised to be equal to, and in some types better than, overseas standards. Stainless and nickel-chrome steels for cases and bands, and glass and special plastic sheet for crystals, are imported, as production of such items is not at present undertaken in Australia.

The imports of watches and cases in 1949-50 were as follows: Complete wrist-watches in cases of non-precious metal, 218,000 valued at £577,358; complete wrist-watches in cases of precious metal, 25,805 valued at £107,617; wrist-watch cases, separately, 15,352 valued at £16,091; watch movements, 422,568 valued at £717,326; watches for use of the blind and watches not elsewhere covered, 242,631 valued at £172,159. Switzerland was the main source of imports except for "watches, n.e.i.", which were mainly supplied by Austria and the United Kingdom. The value of exports of "time-pieces and parts thereof" in 1949-50 was £56,275.

The value of output of watchcases made in Australia is not specifically published in official statistics.

REPAIR of watches and clocks is carried out by both specialist workshops and by retail jewellers employing repair tradesmen. A small quantity of watch parts, such as staffs, is made in Australia, also watch and clock oils.

DOMESTIC EQUIPMENT, NOT ELSEWHERE INCLUDED

The STOVES, OVENS AND RANGES manufacturing industry is an old and well-established one in Australia, and its development has been on a sound basis and well sustained. Commencing about a century ago with the manufacture of fuel stoves, the production of gas and then electric equipment has been undertaken until at present a wide range of products extending from small gas stoves and electric "stovettes" to large commercial ranges is being made. The output of the industry in 1949-50 was valued at £5,501,000. The greater part of this output is from a small number of large organisations, usually operating their own foundries and enamelling plants, but while about one-half of the total employment is concentrated in two large factories, there are small establishments in all States producing limited quantities of either gas, fuel or electric cookers.

The following table shows the value, in 1949-50, of certain items produced on the one hand by those factories classified as stove, oven and range factories and on the other hand by all factories—

PRODUCTION:	1949-50	
	Factories Classified as Stove, Oven and Range Fac- tories	All Factories
Stoves, ovens and ranges—	£	£
Cooking—		
Solid fuel—		
Domestic	569,921	653,656
Commercial	77,462	88,702
Electric—		
Domestic stoves	528,662	1,206,910
Domestic stovettes, cookers, etc.	180,813	537,381
Commercial	(a)	48,962

Gas—		
Domestic	871,579	976,930
Commercial	(a)	98,001
Heating—		
Solid fuel (slow combustion)	207,042	372,704
Electric (b)—		
Domestic	(a)	25,869
Commercial	(a)	11,140
Gas fires and room heaters	(a)	10,151
Oil—		
Kerosene room-heaters .	(a)	211,258
Other	(a)	2,667
Primus type and small spirit burners	(a)	25,708

(a) Not available for separate publication, indicating that only one or a few manufacturers are making each type of product.

(b) Excludes radiators and electric fires, total production of which was valued at £204,675.

The greatest demand is in the field of domestic stoves and ranges, and arises both from the need to equip new homes and the replacement of worn-out or obsolete units. Annual demand in 1951 was estimated at 160,000 units, consisting of a demand from new dwellings of about 70,000 units and a replacement demand of about 90,000 units. There has been a significant easing of demand in 1952.

Australian production in the year 1950-51 was 173,800 units, comprising 73,200 fuel, 55,700 gas and 44,900 electric. Imports are relatively small at about 6,000 fuel, 3,500 gas and 8,000 electric stoves a year. It is estimated that, due chiefly to shortages of skilled labour and current sales difficulties, the industry is working at about 70 per cent. of capacity. Current production, together with imports, is somewhat above the level of current demand. The backlog of demand has now been eliminated.

Many manufacturers in the cooking-range field are also producers of WATER-HEATING EQUIPMENT, wash boilers and similar equipment, and as the two types of manufacture are frequently controlled by the same influences it can be said that, broadly speaking, any comments offered are equally applicable to both.

In 1949-50 there were 1,872 electric domestic HEATING UNITS (not including radiators or electric fans) made in Australia. The industry is meeting practically the whole of the demand. The capacity of the room-heating industry is sufficient to cater for local requirements. In 1949-50 it produced 1,078 gas fires and room heaters, 36,018 kerosene room heaters, 1,183 other oil room heaters and 15,842 primus type and small spirit burners. The number of heating units imported is not available.

Capacity for the manufacture of WASHING MACHINES is adequate to meet the Australian demand. In 1949-50, 31,638 electric washing machines and 13,867 washing machines other than electric were made. Statistics of the number of units imported are not available.

GARDENING AND CURATORS' EQUIPMENT, NOT ELSEWHERE INCLUDED

Australian manufacturers can supply the bulk of Australian requirements of gardening and curators' equipment, with the possible exception of lawnmowers, considerable quantities of which have been imported in the last few years. Details of production, etc., of spades, forks, hoes, rakes, clippers, and similar implements are given in the section, "Hand-tools", earlier this chapter. The only other

IMPORTS:

	1949-50		1950-51	
	no.	£	no.	£
Garden and field rollers; garden-hose reels; lawn sweepers and sprinklers	—	93	—	2,938
Lawnmowers, electrically or petrol driven	12,938	347,638	14,798	488,133
Lawnmowers, all other	26,351	110,127	19,853	100,902
Garden and field spraying machines, garden syringes	—	8,204	—	61,824
Spray pumps, n.e.i., foot or hand operated, including atomisers and vaporisers of the type used for spraying insecticides	—	11,099	—	16,127

statistics available for Australian production are—

PRODUCTION:	1948-49		1949-50	
	no.	£	no.	£
Lawnmowers—				
Power-operated	712	41,310	24,647	396,690
Hand	64,557	226,650	88,425	344,728
Wheelbarrows metal	51,204	149,347	71,603	203,706

Recent imports of gardening and curators' equipment were—

GOLDWARE, SILVERWARE, JEWELLERY

FINE WARE of gold or silver, including ceremonial and ecclesiastical ware, is made in Australia to exacting requirements by jobbing goldsmiths and silversmiths, the establishments of which are usually also engaged in real-jewellery manufacture. A shortage of craftsmen exists in the fine-ware branch of the industry, but demands can usually be met. A few of the electroplate-ware manufacturers also make articles in sterling silver, particularly for presentation purposes.

The value of output of jewellery in Australia—real, "9-ct. and rolled-gold trade", imitation, dress accessories, etc.—is not specifically published in official statistics, either separately or as a whole. Imports in 1949-50 of "imitation jewellery, jewellery commonly known as rolled gold, jewellery under 9 ct.", were valued at £304,610, and were mainly from the U.K. Other jewellery imports were valued at £94,310. Items for personal wear not being of jewellery or imitation jewellery or of precious metals, were imported in 1949-50 to the value of £25,834. Imports in 1949-50 of "beads, strung or unstrung, and necklets", probably

mainly of imitation pearls, were to the value of £315,837, mainly from Czechoslovakia and the United Kingdom. Embroidery bullion valued at £1,642 was imported in 1949-50.

REAL JEWELLERY is made in Australia in adequate quantity and to recognised high standards, particularly diamond jewellery—a trade in which several specialist manufacturers are now engaged. Most of the gems mounted in Australia are imported in polished condition. In recent years, however, LAPIDARY WORK has become well established. In addition to cutting and polishing from the rough, used gems are re-cut and polished, and chipped and scratched stones repaired. Jewels for the bearings of instruments and balances are occasionally made; 1949-50 imports of bearing jewels were valued at £6,351. Imports of jewels, cameos and intaglios, and other precious stones in 1949-50 were valued at £946,712, including 76,682 ct. of diamonds valued at £822,130.

The greater part of JEWELLERY MANUFACTURE in Australia is concerned with

medium-priced to low-priced items known as the "9-ct. gold and rolled-gold trade", producing an extensive range of articles considered to be high in quality of design, workmanship and gold content, and adequately serving its market. Solid 9-ct. gold articles are usually stamped as such. Genuine rolled or filled gold has a silver or a non-precious metal base laminated to a facing of 9 ct. gold of the thickness of one-tenth of total thickness of the laminated metals; if silver is the base, the laminate is called "9-ct. silver-lined". Reputable manufacturers carefully emphasise that such articles are not gold plated, as that method results in an inferior and considerably less durable finish than genuine rolled-gold.

Adequate quantities of trace, curbed and snake ("Brazilian") MACHINE-MADE CHAIN, in gold, silver, rolled-gold, etc., are made in Australia. HAND-MADE CURBED CHAIN such as pocket-watch "Alberts", is usually made to requirements by goldsmiths.

IMITATION JEWELLERY for transient fashion use is being produced in Australia on an increasing scale, particularly high-quality dress jewellery, but only to a modest extent compared to the range and quantity imported. It is likely that importers will hold a substantial advantage for a long period yet because of variety and price factors.

The greater part of personal and costume jewellery consisting mainly of IMITATION

PEARLS is imported in a fully or nearly fully made-up condition. Only one company is known to coat imitation-pearls in Australia; it uses imported fish-silver and imported beads, and makes up its output into necklaces, bracelets, and so on. An attempt to make satisfactory fish-silver in Australia from locally secured fish-scales was unsuccessful.

Practically all precious metals used in the Australian jewellery industry, except platinum, are of Australian origin, but jewellery components other than opals, some types of semi-precious stones, pearl and trochus shell, and true pearls, have to be imported. Diamonds, and other precious and semi-precious gems, are imported both in rough and polished condition. Principal "jewelling" components used in Australia are marcasite stones, tinct and half-tinct glass stones, chatons, coated and uncoated glass beads for imitation-pearl jewellery, glass and china-beads, cameos, and a small quantity of synthetic imitations of gems and cameos. The manufacture of such components in the large variety and relatively small quantity required in Australia, is generally considered to be economically impracticable. Synthetic sapphire (that is, boule and rod sapphire and ruby) is not made in Australia. Jewellery cases, boxes and display pads, and frames, some types of jewellers' tools, are made in Australia. This service to jewellery merchandising appears to meet the demand adequately.

MUSICAL INSTRUMENTS

The manufacture of MUSICAL INSTRUMENTS is established in a small way in Australia, with factories operating in all States except Tasmania. With the exception of one large factory in Sydney, making gramophones, gramophone records, and other items, all factories in the industry are on a small scale. The majority of factories in the industry are concentrated in Sydney.

The major groups in the industry in Australia and items manufactured are as follows—

GRAMOPHONES, RECORDS, ETC.: Gramophones, electric and mechanical; gramophone parts; gramophone records; record players and pick-ups; gramophone needles, steel point, sapphire point; disc-recording sapphires; recording blanks.

PIANOS, PLAYER-PIANOS, ORGANS: Piano making; player-piano making; reconditioning of pianos and players; piano cabinets; piano keyboards; piano actions; player-piano actions; piano parts; music rolls (player-piano); sheet music; organs, pipe and electronic.

OTHER MUSICAL INSTRUMENTS: Guitars, Spanish, Hawaiian, electric; mandolins; banjo-mandolins; ukeleles; violins; drums and drum-sets; drum accessories; recorders and tonettes; metal fifes; electric carillons; sundry small musical novelties.

In 1949-50 the value of output of the industry was £1,492,000, and total imports of musical instruments amounted to £1,181,180.

The value of output in the GRAMOPHONES, etc., section of the industry in 1949-50 was £971,000, compared with imports of gramophones, records, needles, etc., totalling £495,000. This section of the industry has made substantial progress since 1938-39, and the world-wide connections of the main company engaged should ensure adequate future development of its activities.

Value of output, including repairs and reconditioning, in the PIANO section in 1949-50 was £469,000. Imports of pianos, etc., and

parts in 1948-49 were valued at £267,000, being mainly upright pianos, grand pianos and piano actions. In 1949-50 the value of imports rose to £363,000. Little manufacture is currently being undertaken, and the industry at present is largely concerned with the reconditioning of used instruments. Because of a decline in demand the manufacture and import of player-pianos has virtually ceased, and current demand is being met by reconditioned instruments. Capacity for manufacture of music rolls for player-pianos is adequate, but current demand is not being fully met. Demand, however, is likely to continue to decline, and the long-term prospects for this section of the industry are not bright.

The manufacture of ORGANS is a highly skilled occupation, and there are only a few firms engaged in this activity. No statistics of production are available. Organ manufacture is, in effect, a custom trade, each instrument being largely individually designed and built, except for some small instruments and types such as Wurlitzer and Hammond organs, which are all imported. Some parts are not made in Australia, particularly reeds and certain electrical components (mainly magnets). Some metal pipes are imported. Practically all imports come from the United Kingdom. In 1949-50, imports of pipe organs were valued at £1,439, and of other organs and harmoniums at £3,947 (10 instruments).

For musical instruments other than gramophones, gramophone records, pianos, piano players and organs the value of output in 1949-50 was only £52,000 compared with imports of £323,200. The range of BAND and ORCHESTRAL INSTRUMENTS manufactured in Australia is very limited, and there seems little immediate prospect of extension. The

manufacture of GUITARS and DRUMS is well established, and quality is considered to be up to world standards. The manufacture of MOUTHORGANS was considered by a few firms in recent years, and some plastic instru-

ments were produced, but technical difficulties and the competition of imports have prevented further development in this field. PIANO-ACCORDIANS, ACCORDIANS and CONCERTINAS are not made in Australia.

OPHTHALMIC GOODS AND OPTICAL EQUIPMENT

Prior to the 1939-45 War, the manufacturing activities of the optical industry in Australia were very limited. There was no manufacture of any consequence of precision optical instruments and most requirements were imported. The sources of supply in order of importance were Germany, Japan, U.S.A. and the United Kingdom.

In the ophthalmic field, the principal items made pre-war were bifocal blanks, spectacle cases and a small amount of equipment and machinery. Australian production provided for about 75 per cent. of Australian requirements for bifocal blanks and about 30 per cent. for spectacle cases.

During the war, the limited imports available, and the urgent and heavy requirements of the Armed Services for OPTICAL EQUIPMENT, led to a rapid development of the industry. After the cessation of hostilities, however, the reduction in the demand of the Armed Services for precision optical goods and the gradual resumption of imports led to a severe contraction of the precision-instrument section of the industry.

Of the private firms engaged in the precision optical industry during the war only three have continued in production. The largest of these is capable of manufacturing an extensive range of optical goods, as well as ophthalmic equipment and scientific apparatus; an important post-war development by this company has been the production of microscopes, of which seven types are now being manufactured.

An outstanding wartime achievement of the industry in Australia was the manufacture of optical glass. Production, however, has not been continued in peacetime because of the limited requirements of the Australian precision optical industry, the existence of stocks from wartime production, and the competition from imported glass.

The cessation of imports during the war also led to considerable development in the OPHTHALMIC section of the industry, which expanded output of existing products and began production of new items covering a wide range of ophthalmic supplies and equipment.

Two major raw materials, glass (usually in blanks) and cellulose-nitrate sheet need to be imported. Manufacture of ophthalmic-quality glass has not been undertaken in Australia.

The shortage of imported spectacle frames and of imported supplies of cellulose-nitrate sheet during the war, led to the manufacture of spectacle frames of injection-moulded cellulose acetate. These, however, were generally regarded only as a substitute by the trade, and the manufacture of cellulose-nitrate frames was increased as supplies of material became more readily available.

The industry produces lenses (multi-focal and single vision) from imported glass blanks, sunglasses and goggles, spectacle frames (plastic, metal and plastic combined with metal), spectacle cases (wallet and snap type) and

machinery and equipment for the ophthalmic optical trade.

The value of output for 1949-50 was £1,543,000. This amount would include the value of repairs and other work of a service nature. Allowing for these items, the value of articles manufactured is estimated at £1,300,000.

The industry in Australia is meeting about 60 per cent. of the total demand. Imports in 1949-50 of optical and ophthalmic equipment and supplies totalled £768,610, the greater part of which was from the United Kingdom. Italy and France were also significant suppliers of some items. These imports covered the whole range of optical and ophthalmic goods. Precision optical goods accounted for about £155,000 and ophthalmic goods for £613,000.

Imports of optical glass amounted to £61,950 and comprised optical glass in the rough or in sheet form (£8,220), moulded blanks (£47,810), partly finished lenses (£3,460), and other glass for lenses (£2,460).

Finished optical lenses imported were valued at £13,480 and consisted of optical instruments and lenses for sound optical assemblies (£3,050), projection lenses (£490), camera lenses (£780), and other optical lenses (£9,160). Most of the items in this group are being or can be manufactured in Australia.

The total value of optical appliances imported in 1949-50 was £155,000. The largest item in this group was microscopes valued at £76,900. Some of these microscopes would be special types not being manufactured in Australia, but the greater number would be competing with Australian-made articles. Imports of binoculars and parts amounted to £54,440, of which field and marine glasses accounted for £47,930. Other optical appliances imported in 1949-50 were telescopes, £13,930, magnifying and reading glasses, £11,660, and mounted optical lenses, £1,780.

Of ophthalmic goods imported in 1949-50, the largest group consisted of spectacle frames and mountings valued at £358,020. The most important item in this group comprised spectacle frames of plastic, other than injection moulded, £184,680. These would be almost exclusively cellulose-nitrate frames. Imports of frames of injection-moulded plastics were much smaller, amounting to £45,860. Metal frames and mountings imported were valued at £92,900, and combination and other frames at £9,800. The smaller items in this group were parts for spectacle frames, £13,620, and rimless mountings valued at £8,760.

Imports of ophthalmic lenses in 1949-50 amounted to £87,324, of which £20,660 represented blanks, the remainder being ground and polished, edged, etc.

Framed lenses and complete spectacles imported in 1949-50 were valued at £15,614, whilst imports of ophthalmic instruments and appliances amounted to £17,460.

Ray-absorbing glasses and goggles and other goggles imported in the same period were valued at £135,150. The items in this group were—ray-absorbing glasses and goggles, with

optical ground and polished lenses (£22,160), and other lenses (£100,160), ray-absorbing industrial goggles (£2,210), other industrial goggles (£2,470), other protective goggles (£8,140). Imports of spectacle cases amounted to £11,000.

It will be noted that all types of ophthalmic goods imported, as well as a major proportion of the optical goods, are directly competitive with Australian products. This competition has become increasingly acute since the war, and is likely to become more so as Japan and Germany, which supplied a considerable

part of Australia's requirements before the war, re-enter the market.

Exports are relatively small, and in 1949-50 totalled £33,260. The most important item was ophthalmic lenses, valued at £15,830. Optical lenses, partly-finished lenses and blanks exported amounted to £4,350. The other items exported in 1949-50 were optical appliances, £1,800, spectacle frames and parts, £2,890, ray-absorbing spectacles and other protective glasses and goggles, £5,200, and ophthalmic instruments and appliances, £3,180.

ORDNANCE, ARMS AND AMMUNITION

All Armed Services ORDNANCE being made in Australia is made at Commonwealth Government ordnance factories. During the 1939-45 War anti-tank guns and field guns up to medium size were made by non-Government engineering establishments (in conjunction with the Government ordnance factories) in order to meet the high demand. Recent Australian ordnance production has included twin 4.5-in. fully-enclosed turrets for destroyers for the Royal Australian Navy, also S.T.A.A.G. high-angle mountings for anti-aircraft guns. Torpedoes, including air-vessels, were made in Australia during the war.

Imports of GUNS, RIFLES, REVOLVERS, PISTOLS and other types of arms are considerable—£573,420 in 1949-50. Excluding production of arms for defence purposes, there

is a limited amount of production of rifles, chiefly for sporting usage. Single-shot, repeating and high-power rifles of .22 calibre are made in Australia, mainly at a Commonwealth Government small-arms factory in New South Wales, but quantities are also imported. Nearly all shot guns, revolvers and other arms are imported.

There is one manufacturer—the leading chemicals industry company in Australia—of SPORTING AMMUNITION. The chief items of production are bullets of .22 calibre and cartridges of all types for shot guns. Production is short of demand, and it is frequently difficult to obtain supplies. The Commonwealth Government munitions establishments do not make sporting ammunition.

PENS, PENCILS, CHALKS, CRAYONS, SCHOOLROOM EQUIPMENT (NOT FURNITURE), ARTISTS' EQUIPMENT

Factories engaged in the manufacture of PENS and PENCILS in Australia are concentrated mainly in New South Wales and in Victoria. Two small factories in New South Wales are in decentralised locations. Most of the factories are operating on a very small scale, and few produce more than one or two items. Products being manufactured in Australia comprise—

PENS: Ballpoint pens, fountain pens (but not gold nibs), penholders, penhandles, steel pen-nibs.

PENCILS, ETC.: Mechanical (propelling) pencils; wood-encased pencils, black copying and coloured; lead, graphite) for pencils; marking pencils; slate pencils; wax crayons; pastels; blackboard chalk; billiards-cue chalk.

The industry has expanded considerably in recent years. Much of this expansion has been influenced by United Kingdom and United States of America firms, which now have interests in the manufacture of ballpoint pens, fountain pens, pencils and pastels. Other overseas firms in this field are considering the prospects of manufacture in Australia.

In 1948-49 imports of pens, propelling pencils, pen-nibs and holders totalled £893,700, and imports of other pencils, pencil leads, etc., totalled £197,200. The value of output of the Australian industry for the same year was £350,900, and exports totalled only £30,930. By 1949-50 the value of Australian output had risen to £390,000, and imports of fountain pens,

propelling pencils, etc., rose to £1,114,780. Imports of wood-encased pencils, pencil leads, etc., fell, however, to £179,930. Exports in 1949-50, at £23,360, were considerably lower than for the previous year.

The ultimate effect of the advent of the ballpoint pen on the market for ordinary fountain pens and propelling pencils is as yet difficult to estimate. The degree of permanence of the existing demand for ballpoint pens is likewise uncertain at present, although the supply of refills is likely to be an increasingly important line of business.

Scope also appears to exist for the manufacture of gold nibs for fountain pens, both to supply local manufacturers, and to provide replacements for Australian-made and imported pens. Balls for ballpoint pens are imported.

Manufacture of wood-encased pencils, pencil leads, crayons, etc., is increasing, and will probably be sufficient eventually to meet most requirements of the Australian market.

The manufacture of DRAWING INSTRUMENTS in Australia comprises the production of drawing scales, protractors, compasses and dividers, slide rules, drafting machines, including drawing pins, with a range of equipment suitable for schools and technical colleges. Production, import and export statistics are not specifically published.

PHOTOGRAPHIC EQUIPMENT (NOT MATERIALS)

The manufacture of photographic and cinematographic apparatus and appliances in Australia includes the production of film and strip

projectors; box cameras; developing and enlarging equipment; camera accessories; projection lenses; and other ancillary equipment.

Also established in Australia is the only plant in the Southern Hemisphere which manufactures photographic-sensitised materials. The plant is that of Kodak (A'asia) Pty. Ltd., which has overseas connections. A range of miscellaneous photographic equipment is also made by Kodak Australia. The company also provides an extensive range of services for commercial and amateur photographers, and operates wholesale and retail branches throughout the Commonwealth.

Total value of 1949-50 output of photographic and cinematographic apparatus, appliances, materials and services amounted to £2,610,000. In this amount is included developing and printing services. Although no separate pro-

duction statistics are available for the various types of photographic equipment, it is estimated that the bulk of output would be attributable to the production of sensitised materials, with developing and printing services accounting for the largest proportion of the remainder.

Imports of photographic and cinematographic apparatus and appliances in 1949-50 totalled £1,280,000. Of this amount, cameras and magical or optical lanterns accounted for £754,639; whilst imports of home cinematographs valued at £118,419 and parts and accessories for cameras and magical lanterns valued at £100,000 were the other items of major importance.

PROFESSIONAL AND TECHNICAL EQUIPMENT, NOT ELSEWHERE INCLUDED

This group consists of establishments engaged in the manufacture of surgical, medical and dental instruments and appliances, laboratory instruments, X-ray apparatus, and all other types of scientific apparatus generally. During 1949-50, the value of output from the whole group amounted to £1.54 million. The bulk of this amount is accounted for in the production of surgical and medical instruments and appliances.

SURGICAL and MEDICAL INSTRUMENTS and APPLIANCES made in Australia include operating tables, sterilisers, scalpels and forceps of many and various types, hypodermic syringes, artificial limbs, trusses and supports of all types, and a large range of ancillary equipment. Total value of Australian production of surgical and medical instruments and appliances in 1948-49 was £454,496. No dissection of this figure to show separate items is available. Imports of surgical, etc., implements and appliances in 1949-50 totalled nearly £300,000, of which amputating, cupping, dissecting, examining and operating instruments and appliances constituted £245,906, other surgical appliances £33,027, and miscellaneous items and supplies £17,747.

DENTAL INSTRUMENTS and APPLIANCES made in Australia include dental chairs, dental units and lathes, to mention the more important items. Generally speaking, the quality of Australian-made instruments is good, and is improving, though some professional men have a preference for imported items. Imports of dental instruments and appliances in 1949-50 were valued at about £52,000, including

dental units, £45,326, and other appliances, etc., £6,669. (For comment on dental supplies—amalgams, cements, waxes, etc.—see "Finished Shapes of Precious Metals", Chapter 9.)

X-RAY APPARATUS made in Australia covers a wide range of equipment for all uses. There are four companies engaged in manufacture, two of which are predominantly important. The value of Australian production of X-ray apparatus in 1948-49 was £189,842. Imports in 1949-50 were valued at about £60,800, a large proportion of which would be for X-ray tubes, which are not made in Australia.

Although there is some manufacture in Australia of **SCIENTIFIC and LABORATORY INSTRUMENTS and APPLIANCES**, both for laboratory and industrial usage, activity is more in the nature of repair and maintenance than in actual manufacture. The firms engaged in the industry are generally small in size; about 70 per cent. each employ less than ten persons. Total value of output in 1948-49 was £371,194. Products made include revolution and speed counters, thermometers, thermostats (certain types), calorimeters, centrifuges, microscopes, seismographs, radiation detectors, and special-purpose laboratory and scientific equipment. Imports for 1949-50 totalled about £1.5 million, of which the major items were thermostats, £204,640; navigation instruments, aircraft and nautical, £80,690; thermometers, £71,080; drawing, mathematical and surveying instruments, £185,600; laboratory glassware and special equipment, £95,300; and analytical balances, £17,150.

SPORTS REQUISITES

The manufacture of sporting goods has been well established in Australia for many years. Factories are operating in all States. The greater part of the industry is concentrated in Sydney and Melbourne. In the States other than New South Wales and Victoria there are only a few relatively small-scale establishments, apart from a large company making racquets, which has been operating at Launceston, Tas., for many years.

The large number of small and medium-sized firms in the industry usually each specialise in one group of sporting equipment, but most of the larger firms employing over fifty persons produce a wide range covering many types of equipment. These latter firms account for about half the total employment in the industry. Most firms in the industry make only sporting goods, but a few have asso-

ciated activities in other branches of industry such as rubber-goods and leather-goods manufacture. For example, one of the largest manufacturers of racquets is a subsidiary company of the largest rubber-products company in Australia. Leather and leather and canvas sporting goods are made almost entirely by the leather-goods industry.

Decentralisation has occurred on a limited scale. Activities outside the metropolitan areas include the manufacture of tennis racquets at Launceston, Tasmania, golf and tennis balls at Frankston, Victoria, and fishing reels at Newcastle, New South Wales.

The following are the main items of sporting equipment made in Australia—

TENNIS, ETC., EQUIPMENT: Tennis racquets, tennis balls, tennis nets, tennis practice sets, tennis racket presses, squash racquets, squash balls, rac-

quet covers, racquet strings (gut), badminton frames, presses and shuttles.

GOLF EQUIPMENT: Golf clubs, club heads, club shafts, golf balls, golf tees, golf bags, golf-bag buggies, leather grips, golf-club covers.

CRICKET EQUIPMENT: Cricket bats, balls, stumps, pads, gloves, matting.

BASEBALL AND SOFTBALL EQUIPMENT: Bats, balls, mitts, gloves, guards, bases.

FISHING EQUIPMENT: Fishing reels, rods, swivels, rod guides, ferrules, floats, sinkers, lines of gut, nylon or silk, hand-made netting, making-up of nets (using imported netting), flies and other lures.

OTHER SPORTING EQUIPMENT: Football covers and bladders, basketballs, soccer balls, water-polo balls, hockey sticks and balls, lawn bowls, carpet bowls, boxing gloves, punchballs, roller skates, ice skates, ice-hockey sticks and pucks, skis, stocks, racing boats, athletes' starting blocks, gymnasium and physical-culture equipment, playground equipment, table-tennis tables, sporting rifles.

Australian production of certain items of sporting equipment in the years 1948-49, 1949-50 and 1950-51 is given in the following table—

PRODUCTION:	1948-49	1949-50	1950-51
	doz.	doz.	doz.
Racquet frames	23,680	21,960	22,400
Golf clubs	16,510	16,980	13,871
Cricket bats	4,480	2,988	1,896
Balls—			
Cricket	14,095	13,848	11,700
Golf	187,990	132,000	159,300
Tennis	285,240	303,600	276,300

In addition to the above items, in 1949-50 the output of fishing gear was—

PRODUCTION:	1949-50
Reels (doz.)	6,202 £51,704
Rods (doz.)	1,412 52,999
Fishing lines (not plastic) (lbs.)	264,343 139,495
Other appliances	— 66,715
Total value	— £310,913

The value of imports in 1949-50 was £334,349 (compared with exports of £155,748). The main items imported were cricket bats and fishing tackle, which were almost 45 per cent. of the total. The main source of imports of sporting goods is the United Kingdom. The quantity of golf balls imported in 1949-50 was 22,711 dozen, valued at £31,377, representing an increase of about 80 per cent. in quantity over 1948-49. Imports are still continuing, as Australian production does not meet the demand. The imported (English) golf balls and clubs sell at almost the same price as the Australian products, and there is a preference by consumers for the imported articles. A considerable proportion of total imports, however, consists of items which, because of the limited market, are not made in Australia, or are made only in very limited quantities more or less on a handcraft scale, e.g., archery, some skiing and ice-hockey equipment, etc.

The main items exported, to the value of £155,748 in 1949-50, are tennis racquets, tennis gut, lawn bowls, and golf balls, and to a lesser extent fishing tackle and tennis balls. A substantial market has been developed for Australian tennis racquets in South Africa and United States of America, and smaller markets in other countries. This trade is probably capable of further expansion. Australian lawn bowls also have a wide overseas market, including New Zealand, South Africa, United States of America, United Kingdom and Canada. The manufacture of baseball and softball equipment has developed in Australia since the 1939-45 War, and there is some prospect of export of baseball and softball bats.

TOYS AND GAMES

The manufacture of toys in Australia falls into the following groups—

WOODEN TOYS: Various.

METAL TOYS: Scooters, tricycles, pedal-cars, clockwork toys, other wheeled toys, pressed toys, diecast toys, construction sets.

PLASTICS TOYS: Various.

Manufacturers in the industry generally limit their activities to one of the above groups, and there is little overlapping. Factories are operating in all States, but the industry is mainly concentrated in Sydney, Melbourne and Adelaide. There are a few small factories in decentralised locations.

In the first two groups, the majority of manufacturers operate on a very small scale and usually specialise in production of toys, except in the case of rubber toys, which are manufactured in conjunction with other rubber products.

The severe limitation of both imports and local production of toys during the 1939-45 War resulted in the manufacture of a variety of wooden toys, in many cases in "backyard" factories. A large proportion of these toys were of poor design, quality and finish, and with the return to the market of more attractive toys, the demand for the wooden articles generally has declined. A number of the better quality items in this group will, however, continue to retain a market.

The value of output of toys made in Australia in 1949-50 was £2,009,515; in 1938-39 (including novelties) it was £655,500. Of the 1949-50 output of toys, the sheetmetal products industry produced toys valued at £130,310; the

plastics industry £611,134; the rubber-products industry £51,399; and the toys industry proper, £1,216,672.

Manufacture of **SOFT TOYS** has increased substantially since 1939, and it appears that the greater part of the increased demand will be maintained. However, in the case of dolls, it is possible that an increasing proportion of the demand will be met with dolls manufactured from the newer plastics, which have certain advantages over dolls manufactured from fabrics, composition or celluloid.

In addition to establishments engaged wholly or mainly in the making of **METAL TOYS**, a number of light-engineering and sheetmetal-working factories have undertaken the production of toys. An increasing range of metal toys is being manufactured in Australia. Most of these are competitive in quality with imported articles; importers, however, can supply a wider variety of toys than the Australian industry at present, and retain a proportion of the Australian market. Mechanical toys are made by a few manufacturers. At least three make miniature trains, all making the electric type, and two also the clockwork type. Some manufacture of diecast metal toys has been undertaken, but this development has been limited by shortages of diecasting metal and also by the fact that overseas manufacturers have the advantage of a wider market from which to recoup their die-preparation costs. This consideration has already been mentioned in connection with the plastics-moulding industry (see Chapter 7), and applies with particular force to the manufacture of plastics toys.

PLASTICS TOYS are manufactured by the plastics-moulding industry in conjunction with a variety of other plastics products. The manufacture of plastics toys and of diecast metal toys in Australia should continue to expand, particularly if attention is given by manufacturers to originality of design.

Imports provide for about one-third of the total demand, and have increased considerably in value in recent years. The value of imports in 1947-48 was £563,400, increasing to £764,800 in 1948-49, to £1,280,000 in 1949-50 and to £2,052,000 in 1950-51. Prices of imported

toys from the U.K. are often higher than those of comparable Australian products. However, Australian manufacturers are at present facing severe competition from Japanese toys, which have recently returned to the market.

In view of the volume of imports it would appear that scope may exist for further development of toy manufacture in Australia. (All imports are now subject to licence—see Appendix II.)

Exports of toys from Australia are quite small in quantity. Value of 1949-50 exports of Australian-made toys was £26,000.

UMBRELLAS AND WALKING STICKS

UMBRELLAS made in Australia include street umbrellas, parasols, sunshades, together with a range of beach, garden and bookmakers' umbrellas, the latter group being made by canvas-goods manufacturers. Value of output of umbrellas and walking sticks, excluding beach and garden umbrellas, amounted to £436,000 in 1949-50. With the exception of frames for beach and garden umbrellas made by one manufacturer, all frames and fittings for umbrellas are imported and assembled locally. Covering materials are also mainly

imported. Although the production of canvas-type umbrellas is sufficient to meet requirements, local production of other types is not sufficient to meet demands. Imports for 1949-50 totalled £147,000. There is some manufacture of plastic handles, but major requirements are imported. Value of imports of umbrella frames, fittings and handles is not published.

Production of WALKING STICKS in Australia for 1948-49 totalled £25,700. Most of the sticks would be manufactured from Australian-grown timbers.

SHEETMETAL WORKING, FINISHING (COATING, POLISHING, ETC.), WIRE WORKING, SCREWS, BOLTS AND NUTS, CHAIN

SHEETMETAL WORKING, AND ASSOCIATED FINISHING

General Activities

The manufacture of sheetmetal products is well established in Australia. Value of output for 1949-50 amounted to £40,372,000. This amount includes only those sheetmetal products which were manufactured in establishments primarily engaged in sheetmetal-working activities (and also includes the undisclosed value of output of two large steel mills engaged in rolling and coating of steel sheet—see Chapter 9). Apart from the 700 establishments so engaged, many large general and electrical engineering firms have their own sheetmetal-working sections, and production of sheetmetal products from these companies is not included.

The following table presents the value of output of sheetmetal products produced in 1949-50, showing the output of factories classified as sheetmetal-working establishments and the total output for all factories—

	1949-50	
	Factories Classified as Sheet- metal-work- ing Fac- tories	All Factories
PRODUCTION:	£	£
Electrical apparatus—		
Household fittings (switches, fuses, etc.)	109,775	741,662
Wireless chassis (unmounted)	23,207	26,357
Dairying and domestic utensils—		
Milk buckets and cream cans	(a)	218,520
Garbage and sanitary pans	(a)	202,859
Kitchenware—		
Aluminium	340,792	1,032,783
Brass and copper	6,375	45,018
Enamelled	124,265	230,334
Other	916,086	931,358

Sheet and pressed metal-ware—		
Packers' cans, canisters and containers	12,548,072	14,177,430
Crown seals and bottle closures	(a)	874,290
Boxes and trunks	42,518	71,367
Metal furniture and office equipment	249,247	2,253,228
Petrol tanks	54,248	73,633
Wheelbarrows	48,302	203,706
Steel ceiling sheets	(a)	11,977
Metal roofing tiles	—	101,768
Domestic metalware—		
Baths—		
Enamelled	19,188	637,615
Other	107,081	107,081
Sinks—Stainless steel	683,391	1,198,516
Tubs, metal	(a)	12,609
Bath heaters (complete)—		
Electric	22,429	107,579
Gas	149,529	277,012
Other	173,474	212,352
Stoves, ovens and ranges—		
Cooking	563,204	3,755,462
Heating	32,717	684,091
Primus type and small spirit burners	(a)	22,708
Washing machines (household, other than electric)	12,690	65,529
Refrigerators, commercial and industrial, electric	63,676	1,179,446
Machinery, industrial—		
Air conditioning	151,067	823,460
Dairy and buttermaking	27,577	711,606
Pumping	31,173	2,170,717
Metal badges and buttons	104,998	137,586

(a) Not available for separate publication, indicating only one or a few manufacturers are engaged in manufacture of each type of product.

Sufficient capacity exists in the industry to satisfy the requirements of the domestic and commercial fields. However, with increasing demands for heavier types of pressings from industry, particularly in the manufacture of

motor bodies, there is room for expansion. The chief obstacle to increased production of sheetmetal products generally is the shortage of raw materials. The industry has been working on a strict quota basis since the war ended, and although steel sheet has been imported in considerable quantities for some time, it has proved most expensive and is not economical to use in the manufacture of certain items.

Finishing Activities

Surface-finishing trade services, such as electroplating, vitreous enamelling, painting, appear to be reasonably adjusted to demand. In recent years a few firms have established themselves as specialist trade finishers, particularly for consumer products requiring painting (by spraying, dipping, stoving, etc.), application of motifs (by transfers, silk screening, etc.) and final packing in individual cartons and then into transport containers. Many types of consumer goods require a high-grade finish to evoke a satisfactory response from the buying public.

Some Specific Categories of Products

Baths, Basins (sheetmetal): The demand for galvanised sheetmetal baths and basins for domestic use has been steadily declining for several years. The chief source of demand is from the remoter country areas, and in city areas for installation in sub-standard homes. Capacity is adequate to meet this demand.

Builders' Hardware (sheetmetal): See "Hardware", earlier this chapter.

Packers' Cans, General Line Cans, Composite Containers: Australian manufacturers supply the entire requirements of the local market for all types of cans and containers of metal and metal-and-fibre. Value of production in 1948-49 of cans, canisters and containers of sheet and pressed metalware was £11,238,871 and in 1949-50 was £14,177,430. No imports or exports are specified in official statistics. The usage of tinplate for the manufacture of cans of all types totalled 124,600 tons for the twelve months ended 31st May, 1952. Of this amount, 71 per cent. was used by the makers of cans and domestic tinware, and 29 per cent. by canners who make some, or all, of their own can requirements. About 84 per cent. of the tinplate used by can-makers proper was, in fact, used by the two major companies referred to in Part One. It appears that the present trend is for food canners to turn more to the can-maker for supplies of cans rather than to set up auxiliary can-making plant for themselves. Some of the larger canners have expanded their can-making capacity, but generally the smaller companies are not finding it economical to continue the manufacture of cans.

Domestic Tinware: As with cans and containers (see above), Australian manufacturers supply all of the local market requirements. No specific statistics are available.

Dairy Utensils: Production of sheetmetal dairy utensils such as milk buckets, milk and cream cans, etc., by Australian manufacturers is sufficient to meet requirements. No imports or exports are specified in statistics. The only production statistics available are as follows—

PRODUCTION:	1948-49		1949-50	
	no.	£	no.	£
Milk buckets ..	85,975	32,203	152,483	218,520
Milk and cream cans	103,633	185,025		

Drums and Beer-transport Containers: There is no specific statistical information available to show Australian production, imports or exports of metal drums, beer barrels, etc. Production of these items is on an efficient basis. The two manufacturers of beer-transport containers (one makes a drum, the other a barrel, both in stainless steel) are associated with important overseas manufacturers. All Australian requirements of steel containers are being met.

Electroplated and Nickel-silver Ware Manufacture: Capacity in Australia for production of plated ware in all grades and range of jewellers' and hotelware is generally adequate to meet the demand, except for TABLE SPOONS and FORKS of dinner and dessert sizes, manufacturing capacity for which is being extended. A substantial quantity of spoons, forks and other FLATWARE is imported, mainly from the United Kingdom, both in unplated condition for finishing in Australia, and in finished condition. Forks and spoons of unplated, polished nickel-silver are made in Australia, but not of stainless steel. Manufacturing capacity in Australia for small flatware—TEASPOONS, SUGARSPoons, CAKE FORKS and SERVERS, FISH KNIVES and FORKS, and so on—is more than adequate to meet the demand at present for the Australian-made product. Imports of plated ware other than flatware are quite small compared with Australian production. (Spoons and forks are also referred to under "Cutlery and Small Handtools", later this Part.)

Kitchen Utensils: Australian production of kitchen utensils meets most of the local market requirements. Value of kitchenware made in 1948-49 and 1949-50 was—

PRODUCTION:	1948-49	1949-50
	£	£
Kitchenware—		
Aluminium	1,261,938	1,032,783
Enamelled	271,313	230,334
Brass and copper	26,576	45,018
Other	682,448	931,358

For imports of kitchenware, see "Hotel and Cafe Kitchen Equipment", earlier this chapter (those figures include both commercial and domestic equipment).

Medals, Medallions, Trophy-crests, including Vitreous Enamelled: Medal and trophy-crest production in Australia is meeting demand.

Metal Tiles, Ceilings, Dadoes, etc.: Australian production of metal ceiling sheets in 1948-49 was 74,400 sq. yds., valued at £13,363, and in 1949-50, 48,608 sq. yds. valued at £11,977. In 1949-50, production of metal roofing tiles was 2,369,000, valued at £101,768. No further statistics of production (or imports, exports) are available.

Metal Closures: The manufacture of crown seals and other bottle closures is largely in the hands of specialist organisations. Australian production in 1949-50 was valued at £874,290. Imports are small; in 1949-50 they totalled 4,885 gross valued at £3,070, and in 1950-51, 1,755 gross valued at £625. Exports were valued at £13,168 in 1949-50 and at £17,743 in 1950-51.

Metal Trunks and Boxes: Value of Australian production of metal boxes and trunks in 1948-49 was £38,578 and in 1949-50, £71,367, compared with imports valued at £310 in 1949-50 and at £1,058 in 1950-51.

WIRE WORKING

Capacity for the production of WIRE PRODUCTS is about adequate to Australian requirements, but, because of the shortage of feed (wire rod to the wire mills and, consequently, wire from the wire mills to wire-products manufacturers), production has been well below capacity levels. The wire-products manufacturers make a wide range of products, including nails, screws, woven wire, gauzes, wire ropes, wire netting, etc. (a substantial quantity of barbed wire, wire netting, nails, brads, etc., are also made by wire mills).

The following table presents the value of certain wire products made, in 1949-50, and shows the value of articles produced by factories classified as wire-working factories and the total value produced by all factories—

PRODUCTION:	1949-50	
	Factories Classified As Wire-working Factories	All Factories
	£	£
Wire netting	452,658	452,658
Woven wire (including link)	(a)	458,409
Fine wire mesh	387,246	387,246
Nails	(a)	864,950
Staples	19,064	19,064
Reinforcing steel rods	126,299	202,650
Mattresses—		
Woven wire	386,372	679,345
Link mesh	(a)	8,093
Spring	(a)	26,703
Inner spring	98,850	1,917,351
Soft filled and other	55,815	2,108,637
Wire stretchers (including folding beds)	87,684	87,684

(a) Not available for separate publication, indicating that only one or a few manufacturers are engaged in making each type of product.

Serious shortages of practically all wire products, including those of the wire mills, have persisted for several years, and imports have been necessary to meet the demand. Imports of wire products in recent years were—

IMPORTS:	1949-50 1950-51	
	cwt.	cwt.
Barbed wire	152,221	248,510
Wire netting	349,808	559,137
Woven wire for paper making machines	940	595
Wire suitable for fly doors and windows	215	69
Other woven wire—		
120 holes or less to the linear inch	1,612	4,095
Over 120 holes to the linear inch	1,796	550
Wire and manufactures of wire not elsewhere specified or included	£	£
Safety pins, plain	103,937	183,770
Toilet pins, short, solid-headed (household or office) pins	17,336	17,970
Hair pins	35,301	51,404
Hooks and eyes	71,228	46,139
	19,104	8,398

SCREWS, BOLTS AND NUTS

Ample capacity exists to meet demand for BOLTS, NUTS, SCREWS, RIVETS, WASHERS, etc., of all types. However, feed (in the form of rod from the steel mills at the iron and steel works, and wire from the wire mills) has, until recently, been less than 50 per cent. of requirements. Supply of feed from overseas, particularly of standard gauges and sizes, has been difficult to obtain, and much machine capacity in the Commonwealth has been idle. The major producers continue to find it difficult to secure skilled labour. The effect generally has been that service departments and structural and general engineers found it necessary to import many types and

There is ample capacity for the manufacture of NAILS in Australia, but until 1952 a serious shortage of feed necessitated the import both of nail wire for local fabricating and of nails to meet demand. Imports of nails in recent years were—

IMPORTS:	1949-50 1950-51	
	lbs.	lbs.
Wire nails and staples (a)—		
Iron and steel	11,568,274	14,862,031
All other	1,999,553	2,128,990
Nails, n.e.i., and tacks—		
Horseshoe nails	189,375	287,975
Saddlers' tacks (not cut) and nails	91,741	142,590
Nails, n.e.i., including brads, picture nails, gimp pins, spouting screws	2,522,992	3,855,759
Tacks, n.e.i.	1,064,957	1,156,868

(a) All metals are included here for convenience of comparison, as they are made by the same manufacturers as make these products from iron and steel.

Capacity for the manufacture of STEEL WIRE ROPE is generally equal to the estimated demand, although supplies are not always freely available. The manufacturing range is from ¼-inch to 10-inch circumference, with breaking strains up to 343 tons. Types made include black and galvanised, semi-flexible, flexible, and compound constructions, special flexible, and patented types up to 6 strands of 91 wires each, in weights up to 10 tons continuous without splicing. Imports of wire ropes in recent years were—

IMPORTS:	1949-50 1950-51	
	cwt.	cwt.
Wire and cable, stranded or twisted, and metal cordage, of iron and steel—		
Metal clothes line	9,945	9,078
Other, under 1 inch in circumference	11,849	13,327
Other, 1 inch and over in circumference	23,126	35,707

The demand for SPRINGS from the heavy transport and automotive industries, and for general manufacturing purposes, has been greater than current production. Shortage of skilled labour in the springmaking establishments was offset to some degree by the short supply of spring steel and wire, but by mid 1952 both steel and labour were in adequate supply. The industry depends upon imports for very heavy-gauge drawn wire in long coils. Sufficient plant capacity exists for all types of springs made in Australia, and nearly all types are made. (See Chapter 10, "Transport Equipment", for automotive and other transport suspension springs.)

sizes of black and bright bolts and nuts, at more than double the price of the Australian-made products. Supplies from local manufacturers have been, in general, adequate to demand in 1952. The value of output of screws, bolts, nuts, rivets and washers (the only items for which information is collected), in recent years was as follows—

PRODUCTION:	1947-48 1948-49 1949-50		
	£	£	£
Screws	336,031	537,535	601,469
Bolts and nuts	1,146,461	1,065,183	1,418,273
Rivets	136,417	104,780	18,326
Washers	154,761	125,776	167,860

Imports in recent years were—

IMPORTS:	1949-50	1950-51		1949-50	1950-51
	lbs.	lbs.		lbs.	lbs.
Bolts and nuts (a)—			Other metal screws for wood, n.e.i.	34,715	24,734
Iron and steel	4,931,380	16,069,538	Screws, n.e.i., including sash screws and attachments.	53,170	71,894
Other metal	70,446	166,581	Screw hooks, eyes and rings	17,191	8,002
Screws (a)—			Washers (metal) (a)—	lbs.	lbs.
Screws with nuts or for use with nuts; engineers' set screws	452,251	889,287	Copper	2,119	1,518
Brake and plough screws, music stool, table, roofing and spiral screws	£ 16,729	£ 14,282	Other, n.e.i.	265,949	479,876
Iron and steel screws for wood, n.e.i.	102,875	128,767	Rivets (a)—		
			Bifurcated	247,687	242,647
			Other than bifurcated, copper	1,592	3,617
			Other, n.e.i.	813,266	1,306,373

(a) All metals are included here for convenience of comparison, as they are made by the same manufacturers as make these products from iron and steel.

CHAIN OF ALL TYPES

A wide variety of CHAIN is made in Australia, including welded and cast steel link chains, cast iron chains, fabricated steel chains, and many types of small miscellaneous chains. The types and sizes of the various classes of chains made by the Australian manufacturers are set out in Part One of this Chapter. These manufacturers have sufficient capacity to supply practically all the Australian requirements of the types they make, with the exception of small-pitch chain for power transmission (the total output of the one recently-established maker of this type of chain is going to meet urgent requirements of agricultural implement manufacturers). No official statistics on Australian production of chain

are available, because the information is not specifically collected. Imports of chain and chains in recent years were—

IMPORTS:	1949-50	1950-51
	cwt.	cwt.
Chain and Chains of Base Metal—		
Wrought iron and steel, composed of welded links, manufactured from metal $\frac{1}{2}$ -inch in diameter and over	2,788	6,870
Machine driving, sprocket and link belting—		
Wholly or partly of malleable cast iron, except roller and inverted tooth type	1,246	3,080
Roller and inverted tooth type	19,292	19,095
Chain and chains of base metal, n.e.i.	8,094	11,018

SERVICE ACTIVITIES—TRADE SERVICES, SUB-CONTRACTING, JOBBING, MAINTENANCE AND REPAIR

Such activities, to mention only a few, as MACHINING, REPETITION ENGINEERING, GENERAL JOBBING, DIE-SINKING and ENGRAVING, and similar types of engineering activity are carried on by large numbers of companies and businesses, generally small to medium sized. The smaller firms usually specialise in one or other of the above activities,

whilst the larger organisations frequently provide a wide range of services. These firms depend for full employment on their ability to make contact with general engineering firms requiring their services, and not infrequently experience "feast or famine" conditions of work offering.

Part Three: Basic Statistics

COMPARATIVE STATISTICS, 1938-39/1949-50

NUMBER OF ESTABLISHMENTS AT 1938-39 AND 1949-50

NUMBER OF EMPLOYEES AT 1938-39, 1949-50, JUNE 1950, SEPTEMBER 1951

Activity (Statistical Sub-classes used by Commonwealth Statistician, 1949-50)	Establishments		Employees			
	1938-39	1949-50	1938-39	1949-50	June 1950 (a)	Sept. 1951 (a)
	no.	no.	no.	no.	no.	no.
Plant, Equipment and Machinery, including Machine Tools (b)	(c) 1,009	1,498	(c) 26,222	56,344	(d) 68,413	(d) 73,331
Other Engineering (b)		1,495		16,798		
Cutlery and Small Hand Tools (c)	63	136	777	2,901	2,808	2,959
Agricultural Machines and Implements (f)	161	208	6,563	10,454	10,477	11,293
Sheet Metal Working, Pressing and Stamping, and Iron and Steel Sheets (g) (b)	(h) 402	698	(h) 12,386	21,041	23,087	24,261
Wire and Wire Working (including Nails) (j) (b)	117	200	4,333	5,893	6,223	6,365
Stoves, Ovens and Ranges	54	65	3,693	4,728	4,941	4,991
Gas Fittings and Meters	9	12	559	672	(k)	(k)
Sewing Machines (i)	14	20	133	281	(m)	(m)
Arms, Ammunition (excluding Explosives)	5	13	451	4,006	4,175	4,574
Other Metal Works (n)	(o) 223	194	(o) 3,650	2,234	(p) 3,685	(p) 3,945
Jewellery (q)	113	(s) 188	1,174	(s) 2,265		
Watches and Clocks (including Repairs) (r)	60	(s) 127	724	(s) 1,323	(t) 3,501	(t) 3,371
Electroplating (Gold, Silver, Chromium, etc.) (u)	112	304	1,755	3,050	2,494	2,289
Gramophones and Gramophone Records	3	6	165	834		
Pianos, Piano-players, Organs	27	40	237	541	(t) 1,000	(t) 1,041
Other (of Class XIV, "Musical Instruments")	4	13	49	81		
Optical Instruments and Appliances (v)		110		1,321		
Surgical and Other Scientific Instruments and Appliances (w)	(x) 130		(x) 912		(t) 2,691	(t) 2,646
Photographic Material (including Developing and Printing) (y)	(y)	(y)	(y)	(y)	(y)	(y)
Toys, Games and Sports Requisites (z)	95	186	2,046	3,176	3,159	3,200
Bone, Horn, Ivory and Shell	(aa)	(bb)	(aa)	(bb)	(cc)	(aa)
Pencils, Penholders, Chalks, Crayons	2	18	48	306	163	157
Umbrellas and Walking Sticks	11	17	204	287	(dd)	(dd)
Other (of Class XV, "Miscellaneous Products") (cc)	71	138	1,585	1,803	(ff) 1,997	2,211
Totals (gg)	2,775	5,836	67,666	141,814	138,814	146,634

STATISTICAL SUMMARY, 1949-50

EMPLOYMENT, MALE AND FEMALE

SALARIES AND WAGES PAID, IN TOTAL AND PER PERSON ENGAGED

VALUE OF PRODUCTION

VALUE OF MATERIALS, POWER, FUEL, REPAIRS, etc. }

See Explanations,
Appendix IV

VALUE OF OUTPUT

Activity (Statistical Sub-classes used by Commonwealth Statistician, 1949-50)	Employment			Salaries and Wages Paid		Value of Production	Value of Materials, Fuel, etc. Used	Value of Output
	Males	Females	Persons	Total	Per Person Engaged			
	no.	no.	no.	£'000	£	£'000	£'000	£'000
Plant, Equipment and Machinery, including Machine Tools (b)	51,620	4,724	56,344	26,495	470	40,958	39,532	80,490
Other Engineering (b)	15,794	1,004	16,798	6,977	415	11,086	6,877	17,963
Cutlery and Small Hand Tools (c)	2,465	436	2,901	1,265	436	2,202	1,571	3,773
Agricultural Machines and Implements (f)	9,789	665	10,454	5,012	479	6,983	7,202	14,185
Sheet Metal Working, Pressing and Stamping and Iron and Steel Sheets (g) (b)	16,091	4,050	21,041	9,128	434	16,240	24,132	40,372
Wire and Wire Working (including Nails) (j) (b)	5,071	812	5,883	2,634	448	4,581	6,315	10,896
Stoves, Ovens and Ranges	4,340	388	4,728	1,989	422	3,114	2,387	5,501
Gas Fittings and Meters	609	63	672	295	439	306	267	663
Sewing Machines (i)	247	34	281	115	409	227	100	336
Arms, Ammunition (excluding Explosives)	3,673	333	4,006	1,848	461	2,256	1,784	4,040
Other Metal Works (n)	1,765	469	2,234	876	392	1,311	675	1,986
Jewellery (q) (s)	1,643	622	2,265	892	394	1,503	1,535	3,038
Watches and Clocks (including Repairs) (r) (s)	1,064	259	1,323	556	420	800	641	1,441
Electroplating (Gold, Silver, Chromium, etc.) (u)	2,801	249	3,050	1,243	407	1,932	969	2,901
Gramophones and Gramophone Records	515	319	834	207	356	377	594	971
Pianos, Piano-players, Organs	519	22	541	219	405	314	165	469
Other (of Class XIV, "Musical Instruments")	80	1	81	27	333	35	17	52
Optical Instruments and Appliances (v)	1,103	218	1,321	536	406	875	705	1,580
Surgical and Other Scientific Instruments and Appliances (w)	1,207	278	1,485	580	397	894	649	1,543

Activity (Statistical Sub-classes used by Commonwealth Statistician, 1949-50)	Employment			Salaries and Wages Paid		Value of Production	Value of Materials, Fuel, etc. Used	Value of Output
	Males	Females	Persons	Total	Per Person Engaged			
	no.	no.	no.	£'000	£	£'000	£'000	£'000
Photographic Materials (including Developing and Printing) (y)	(y)	(y)	(y)	(y)	(y)	(y)	(y)	(y)
Toys, Games and Sports Requisites (z)	2,051	1,125	3,176	1,125	354	1,853	1,500	3,353
Bone, Horn, Ivory and Shell	(bb)	(bb)	(bb)	(bb)	(bb)	(bb)	(bb)	(bb)
Pencils, Penholders, Chalks, Crayons	158	148	306	114	373	190	200	390
Umbrellas and Walking Sticks	90	197	287	93	324	163	273	436
Other (of Class XV, "Miscellaneous Products") (cc)	1,212	591	1,803	705	391	1,292	985	2,277
Totals (gg)	124,807	17,007	141,814	63,030	444	99,582	99,074	198,656

Explanatory Footnotes to Both Tables

- (a) These employment figures are taken from monthly payroll-tax returns and differ slightly from the other employment figures, which are supplied on annual factory returns.
- (b) See the applicable sections, Parts One and Two of this chapter, for details of activities within the sub-classes "Plant, Equipment and Machinery, including Machine Tools", "Other Engineering", "Sheet Metal Working, Pressing and Stamping", and "Wire and Wire Working (including Nails)".
- (c) At 1938-39 the then sub-class "Engineering (not Marine or Electrical)", a sub-class now not existent, comprised—
- Ferrous foundries of a type that were included in the subsequent (1945-46 and onwards) sub-class "Foundries (Ferrous)". (Other ferrous foundries classifiable as such were also included at 1938-39, and until 1944-45, in the sub-class "Smelting, Converting, Refining, Rolling of Iron and Steel".)
 - Engineering activities of types that were included in the subsequent (1945-46 and onwards) sub-class "Plant, Equipment and Machinery, including Machine Tools". (Other engineering activities classifiable as such were also included at 1938-39, and until 1944-45, in the sub-class "Smelting, Converting, Refining, Rolling of Iron and Steel".)
 - Engineering of a general and jobbing nature, not marine or electrical, that was included in the subsequent (1945-46 and onwards) sub-class "Other Engineering".
- See also footnote (c), Part Three, Chapter 9, "Metals, Shapes, Pipes, Tubes, Castings, Forgings".
- (d) Includes also employment for the sub-class "Sewing Machines". Separate figures for each sub-class of this group were not published.
- (e) Also includes saw repairing, knife grinding. Does not include powered hand tools.
- (f) Includes pastoral machines and implements (which includes sheep-shearing machines, wool-presses, etc.); orchard machines and implements (mainly spraying units); machinery and equipment for milking and milk processing (including butter and cheese); incubators and hatcheries. Does not include tractors, which are included in the sub-class "Plant, Equipment and Machinery, including Machine Tools" (see footnote (b) above).
- (g) Also includes plated ware (hollow-ware and flatware). Added to the statistics of the sub-class are the statistics of another sub-class, "Iron and Steel Sheets", which is always grouped that way in official statistics because only one manufacturer is concerned. Steel sheet is made in Australia only at four establishments. Three are operated by one company, Lysaght's Works Pty. Ltd.; the statistical details of two of those three establishments, both engaged in the rolling and coating of steel sheets (and employing about 3,000 persons in total), are included with sheet-metal-working statistics; the company's other establishment rolls, but does not coat, steel sheets, and in official statistics is included in the sub-class "Smelting, Converting, Refining, Rolling of Iron and Steel" (see Chapter 9). The fourth establishment, that of Commonwealth Steel Co. Ltd., makes stainless-steel sheet, and being a steel works and steel mill making a wide range of steels and finished shapes is in official statistics included in the sub-class "Smelting, Converting, Refining, Rolling of Iron and Steel". The activities of rolling and coating of steel sheet are dealt with in this study as a steel-mill activity, and are therefore included in Chapter 9, "Metals, Shapes, Pipes, Tubes, Castings, Forgings".
- (h) Also includes activities which at 1938-39, and until 1944-45, comprised the then sub-class "Art Metal Works", a sub-class now not existent.
- (j) Includes the three wire-mills in Australia which make steel wire for sale as such (each of those mills also being considerably engaged in manufacture of wire products). Includes both ferrous and non-ferrous wiremaking and wireworking. (However, the making of non-ferrous wire in Australia takes place almost entirely in establishments otherwise classified—those making copper and/or copper-alloy finished shapes and/or power and communication wires and cables.) Includes steel wool; tacks; springs made from wire. Does not include screws, bolts and nuts, chain, made from wire (all are included in Plant, Equipment and Machinery, including Machine Tools).
- (k) Included with employment for the sub-class "Other Metal Works" (see footnote (q) below).
- (l) Assembly, repair, maintenance, re-building; no one of the establishments included within the sub-class makes a sewing-machine head.
- (m) Included with employment for the sub-classes "Plant, Equipment and Machinery, including Machine Tools" and "Other Engineering" (see footnote (d) above).
- (n) The sub-class "Other Metal Works" is one of miscellaneous activities not elsewhere included in the Commonwealth Statistician's Class IV, "Industrial Metals, Machines, Conveyances". The sub-class includes non-electric lamps and fittings, and repairs; type founding; die sinking and/or engraving; stencil cutting; key cutting and lock repairing; office machines assembly, repair, maintenance, re-building.
- (o) Also includes activities which at 1938-39, and until 1944-45, comprised the then sub-classes "Lamps and Fittings" and "Die Sinking and Engraving", both sub-classes now not existent.
- (p) Includes also employment for the sub-class "Gas Fittings and Meters". Separate figures for each sub-class of this group were not published.
- (q) Includes goldware and silverware; gem cutting; and imitation jewellery. Does not include watch-cases, which are included in the sub-class "Watches and Clocks".
- (r) Also includes watch-case manufacture (and wrist bands and straps for watches when made in conjunction with watch-cases as an ancillary activity).
- (s) Establishments in Queensland, South Australia and Tasmania classifiable within the sub-class "Jewellery" were included in the sub-class "Watches and Clocks (including Repairs)".
- (t) Separate figures for each sub-class of this group were not published.
- (u) Trade electroplating and polishing only, not metal working.

- (v) Includes ophthalmic goods; and optical elements and assemblies, including lenses.
- (w) Includes dental instruments and equipment; medical and surgical instruments and equipment; X-ray apparatus and accessories; orthopaedic appliances (including artificial limbs); artificial teeth; engineering instruments; mechanics' measuring tools; laboratory instruments; precision balances and weights; and scientific apparatus not elsewhere included.
- (x) At 1938-39 the then sub-class "Surgical, Optical and Other Scientific Instruments" comprised the present sub-classes "Surgical and Other Scientific Instruments and Appliances" and "Optical Instruments and Appliances".
- (y) Includes cameras, parts and accessories (excluding lenses), sensitising of film and paper, developing of photographic negatives and printing of photographic positives. The manufacture of cameras, parts and accessories is not statistically separated from the manufacture of materials and post-exposure processing other than for limited statistics of production of equipment, apparatus, etc. The activity of camera equipment, etc., manufacture is dealt with in this study in this chapter, "Machinery, Plant, Equipment, Apparatus, Not Elsewhere Included". The activities of materials preparation and post-exposure processing, which constitute the greater part of the sub-class, are dealt with in this study in Chapter 5, "Paper Products, Printing, Signwriting, Photographic Materials". The statistics for the sub-class are also dealt with in Part Three of that chapter.
- (z) Also includes the manufacture of rubber goods (golf balls, tennis balls, etc.), wooden articles, cane articles, leather and leather/canvas goods, etc., where such are sports requisites and are made within establishments solely or mainly engaged in manufacture of sports requisites.
- (aa) At 1938-39 and at September 1951 the statistics of the sub-classes "Linoleum, Leathercloth, Oilcloth, etc.", "Bone, Horn, Ivory and Tortoiseshell" (changed to "Bone, Horn, Ivory and Shell" at 1945-46) and "Celluloid and Similar Compositions" (changed to "Plastic Mouldings and Products" at 1945-46) were grouped into one set of statistics.
- (bb) The 1949-50 statistics of the sub-classes "Bone, Horn, Ivory and Shell" and "Linoleum, Leathercloth, Oilcloth, etc." are presented in this study in one set of statistics—see Part Three, Chapter 17, "Products of Textiles, Wastes, Cordage, Hair, Felt, Not Elsewhere Included".
- (cc) Included with sub-class "Other" (of Class XV)—see footnote (ff) below.
- (dd) The monthly employment statistics of this sub-class and of two other sub-classes, "Other" (of Class VII, "Clothing except Knitted") and "Gloves", were grouped into one set of statistics—see footnote (n), Part Three, Chapter 16, "Clothing, Manchester, Napery, Footwear". Separate figures for each sub-class are not provided in the statistics source used.
- (ee) The sub-class "Other" is one of miscellaneous activities not elsewhere included in the Commonwealth Statistician's Class XV, "Miscellaneous Products". The sub-class includes, where carried on as the sole or major activity, restoration of antiques; bottle washing (by bottle collectors and dealers); casein manufacture; charcoal burning; repair of chinaware and glassware; water distilling; french polishing; hydraulic power; lampshades (not fabric); pattern books (swatches of fabrics); porcelain enamelling; signwriting; spray painting; steam generation and supply; straw envelopes. In this study some of the above activities are dealt with elsewhere than in this chapter, "Machinery, Plant, Equipment, Apparatus, Not Elsewhere Included".
- (ff) Includes employment for the sub-class "Bone, Horn, Ivory and Shell". Separate figures for each sub-class were not published.
- (gg) Consideration and comparison of totals must take into account the effects stated in footnotes explaining the composition of certain sub-classes and figure units.

Chapter 13:

FOOD and REFRIGERATION

ANIMAL FOOD

BEVERAGES

TOBACCO

Part One: Structure of Established Manufacturing Activities

THE activities of processing and/or manufacturing of food, beverages and tobacco, and of refrigeration, are established in Australia as listed below, the extent of association of activities being shown by bracketing and annotation. The listing is intended to be reasonably indicative, but not necessarily fully inclusive.

THE FOOD INDUSTRIES

WHEAT MILLING

In 1949-50 there were 161 flour mills compared with 164 in 1948-49, of which more than half were situated in wheat-growing areas. Of the 1948-49 total, 36 mills each employed up to ten persons, 38 each from 11 to 20 persons, 72 each from 21 to 50 persons, 15 each from 51 to 100 persons, and 3 each more than 100 persons. The larger flour mills are situated in Melbourne and Sydney; some of these mills have one or more subsidiaries in country towns. In addition to wheat milling a few flour mills grist maize, oats, barley, peas, rye and rice. The main production is wheaten flour, bran, pollard, and wheatmeal; to a lesser extent sharps, semolina, self-raising flour and breakfast foods. Small quantities of oatmeal, split peas and pearl barley are processed in flour mills. Substantial quantities of cereal products are made in grain mills, other than flour mills, including self-raising flour, wheatmeal, wheaten and corn breakfast foods, cornflour, corn meal, rolled and crushed oats, polished rice, rice flour and meal, split peas, pearl barley and other meals. (See following activity.) Flour is sent from mills to subsidiaries in separate buildings for starch manufacture.

CEREAL FOODS AND STARCH PREPARED ELSEWHERE THAN IN FLOUR MILLS

In 1949-50 there were 78 establishments compared with 76 in 1948-49, mainly situated in metropolitan areas. Of the 1948-49 total, 20 establishments each employed up to 10 persons, 22 each from 11 to 20 persons, 12 each from 21 to 50 persons, 16 each from 51 to 100 persons, and 6 each more than 100 persons; those six establishments employed 1,542 persons out of the total of 3,500 in all mills engaged in the activity. Some of the larger of the establishments are wholesale grocers and manufacturers of grocery preparations. Cereal foods and starch manufacture other than in flour mills is carried on as listed below—

Self-raising Flour manufacture: Often a specialist activity throughout Australia; sometimes associated with large bakeries and wholesale merchants.

Simulated Rice manufacture from wheat: Two producers.

Starch manufacture mainly from wheat: Mostly an activity joined with manufacture of other cereal foods; one company produces potato starch.

Macaroni, Vermicelli and Spaghetti manufacture: Three major and a few smaller manufacturers, mainly specialising.

Gluten manufacture: About twelve manufacturers; a small-scale activity sometimes associated with manufacturing of adhesives, cereal food and starch.

Maize processing: One large company is a maize-products specialist producing most of the glucose made in Australia and a substantial quantity of the total Australian production of maize oil and cornflour; and three other companies making small quantities of glucose. A small number of general millers produce maize cornflour, some of which make starch, custard powder, ice-cream mix and other manufactured products. Milling of corn for bran and meal are adjuncts to the production of cornflour; poultry and other stock foods are also prepared by some of these processors. (Dextrose is made in Australia by two manufacturers of pharmaceuticals.)

Rice polishing and milling: Thirteen mills. Most Australian rice is polished, a substantial quantity is made into meal and small quantities of flour are produced. Some rice mills are also general millers.

Oats processing: Rolled and crushed oats are produced by specialist companies, general millers and by some flour millers. This activity is sometimes associated with the milling of rye, peas and poultry foods.

Breakfast foods (crushing and baking of wheat, corn, oats, rice and bran): Three large specialist manufacturers making a range of breakfast-food products, and a few other large companies;

the latter are mainly engaged in production of breakfast foods, but in most instances are also engaged in packing of grocers' sundries and, in one instance, diabetic and health foods.

Rye and Peas milling (unassociated): One specialist company.

Peas splitting: A substantial activity, mainly by general millers.

Barley polishing: A substantial activity by general millers.

MALT AND MALT EXTRACTS

Malting: In 1949-50 there were 28 maltsters, producing barley, wheaten and oaten malt, the bulk, however, being barley malt; five maltsters each employed more than 50 persons. (The production of malt in Australia is an activity usually apart from brewing and distilling, but some brewers and one distilling company are also maltsters.)

Malt-extract manufacture: A few specialist companies.

ARROWROOT

Arrowroot milling: A small-scale activity, confined to Queensland. In 1949-50 there were 11 establishments, none of which employed more than 10 persons. Most milling is done by growers who operate small milling plants.

SUGAR MILLING, SUGAR REFINING

Sugar Milling: In 1949-50 there were 35 milling establishments, mainly confined to Queensland; some sugar cane is also crushed in New South Wales. In 1948-49, 29 of the mills each employed more than 100 persons, and collectively employed 5,559 out of the industry total of 5,974 persons. (A large quantity of molasses is produced as a co-product to raw sugar.)

Sugar Refining: Six refineries, in five States of the Commonwealth. Five of the refineries are operated by one company, also engaged in sugar milling, gypsum and asbestos mining, and manufacture of wallboards of various types, floor-tiles, etc. The other refinery is operated by a company also engaged in sugar growing and milling. In 1948-49 a beet-sugar refinery in Victoria employed 14 persons, but it has since ceased to operate. The other six refineries, each with more than 100 employees, collectively employed about 3,000 persons. In addition to refined sugar of various grades, the refineries produce substantial quantities of golden syrup, treacle and molasses.

ANIMAL AND BIRD FOODS (other than meat and fish meals)

Chaffcutting, Graincrushing and Other Stock-food manufacture: In 1949-50 there were 189 establishments compared with 192 in 1948-49 wholly or mainly engaged in chaffcutting and/or grain-crushing; and 71 compared with 73 in making animal and bird foods. Of the 1948-49 establishments only three chaffmills, etc., and only five animal-food factories, each employed from 21 to 50 persons. Many of the establishments are solely engaged in chaffcutting; in other establishments the activities shown above are often associated. Some grain-dealers specialise in animal-food manufacture, and some are engaged also in grain cleaning, cage-bird seed preparation and packing, and manufacture of licks. Prepared fish-food is made in Australia by a few small manufacturers. (Dog biscuits are made mainly in biscuit factories.) Animal foods are also prepared by many firms, including wheat millers and oat millers, whose main activities are considered elsewhere, but which use their by-products, and probably other raw materials, for stock preparations.

FRUIT AND VEGETABLE PROCESSING AND PRESERVING; GROCERY PREPARATIONS

FRUIT PRODUCTS:

Jam, conserves, fruit spreads, jellies.

Fruit preserved in liquid—apricots, peaches, pears, pine-apples, fruit salad, berry fruits and other fruits.

Pie apple, apple sauce.

Fruit juices, natural—pineapple, citrus and other.

Fruit juices, natural—concentrated.

Fruit pulp for own use and for sale.

Fruit, dehydrated, including sun-dried fruits.

Crystallised fruit (some produced in confectionery factories).

Candied peel.

In 1949-50 there were 480 establishments compared with 468 in 1948-49 wholly or mainly engaged in one or more of the activities listed on the left, which are carried out in Australia in a complex pattern of overlapping activity. Apart from canneries, packing sheds and some other activities located near the source of supply of main raw materials, the greater part of production is from factories in metropolitan areas. Some of these establishments are large manufacturing specialists particularly in fruit canning, vegetable canning and jam making. Some of the largest establishments are manu-

VEGETABLE PRODUCTS:

Vegetable preserved in liquid—asparagus, beans, (including baked), beetroot, cabbage, peas, tomatoes, carrots, silver beet, and other.

Tomato juice.

Tomato sauce.

Tomato soup.

Tomato pulp for own use and for sale.

Vegetables, dehydrated—cabbage, potatoes and other.

OTHER PRESERVING OF FRUIT AND VEGETABLES:

Pure fruit-juice cordials and syrups.

Flavoured cordials and syrups.

Imitation cordials and syrups.

Sauces—Worcester and other.

Soups—all kinds.

Chutney and pickles.

Vinegar.

GROCERY PREPARATIONS:

Coffee roasting, grinding and packing.

Coffee essence.

Tea blending and packing.

Processing and packing of spices, pepper, mustard, curry, ginger, herbs.

Manufacture and packing of custard powder, saline powder, baking powder, jelly crystals, cubes and tablets, self-raising flour, ice-cream mix, cake, pastry, scone and doughnut mixes.

Flavouring essences—industrial and domestic (see also Chapter 6, "Chemical and Associated Industries").

Peanut butter, lemon butter, sandwich spreads, mayonnaise.

Icing sugar.

YEAST:

Yeast—fresh and dried (sometimes associated with production of vinegar and/or malt).

Honey blending, processing and packing.

facturing merchants whose activities combine manufacturing with processing, by canning or bottling, of fruits, vegetables, jams, pickles, sauces, chutney, soups, pulps, juices, essences, vinegar, cordials and, to some extent, a range of dry preparations ("grocers' sundries"). Many firms within this group of activities are directly concerned with growing fruit and vegetables either by ownership of orchards or gardens or by association with co-operative growers' associations. (The State of Victoria has the largest fruit-canning capacity in the Commonwealth, followed by New South Wales and South Australia. Exports of all canned fruit and vegetable products, dried fruits and honey are maintained at a high level. Australia is in aggregate the third largest exporter of canned fruits and dried fruits in the world.) Other large merchandising establishments combining extensive importing with manufacturing have their greatest manufacturing activity in a wide range of grocery preparations, including self-raising flour, breakfast foods (milled or baked), general milling, and in some instances tea and coffee blending and packing: two companies are principally concerned with tea and coffee. A large number of smaller establishments collectively produce all types of products listed at the left; many are specialists in one type of activity (including canning) and sometimes one product; some, including smaller manufacturing merchants, are engaged upon several of the activities and produce a range of products.

The following table shows the 468 establishments grouped according to employment size as at 1948-49 for four associated activities within the food industry in Australia—

EMPLOYMENT SIZE OF FACTORIES:

	Up to 10	11- 20	21- 50	51- 100	Over 100	Total Establishments
Canneries and jam making	no.	no.	no.	no.	no.	no.
Pickles and sauce making	27	30	24	16	26	123
Grocers' preparations	25	9	12	7	6	59
Dried fruits and vegetables	101	47	52	17	9	226
	14	20	20	5	1	60

The 26 canning, etc., establishments each with more than 100 employees collectively employed 7,065 persons out of the canning total of 9,626 persons. The 13 pickles, etc., establishments each employing more than 50 persons collectively employed 1,322 persons out of the pickles, etc., total of 1,944 persons. The greater part of employment in the grocers' preparations activity is in the medium-size establishments, the 26 largest establishments employing collectively only 2,296 persons out of the activity total of 5,182 persons. The 11-50 group in the dried fruits and vegetables activity collectively employed 1,003 persons out of the activity total of 1,598 persons.

ABATTOIRS, MEAT PRESERVING AND PROCESSING, ANIMAL BY-PRODUCTS

Slaughtering of animals for local consumption.

Slaughtering of animals and poultry for Australian and export trade in carcase meats, canned and preserved meats, smallgoods and by-products, meat boning and packing.

Slaughtering, packing and freezing of poultry for export.

Packing and freezing of rabbits for export.

Slaughtering of pigs for pig-meat export.

Slaughtering of pigs, associated with bacon and ham curing and canning, smallgoods manufacture, and by-products.

There are many abattoirs in Australia, including some that are operated by State and municipal authorities, located in metropolitan areas and some of the larger inland cities and towns. Many country butchers kill stock, for local retailing, on their own premises. The large metropolitan, coastal and inland abattoirs, in addition to providing slaughtering facilities for local meat supply, also provide these facilities for the meat export trade.

DAIRY PRODUCTS

Butter, including concentrate, ghee.

Cheese.

Processed cheese (loaf and packeted).

Milk—condensed.

Milk—concentrated.

Milk—powdered (spray and roller full-cream and skim, butter-milk and whey); and casein.

Malted milk powder, invalid and baby-food preparations.

Ice cream, and ice-cream mix.

Condensing and concentrating are frequently associated activities, and are sometimes also associated with powdered-milk products manufacture.

In 1949-50 there were 481 establishments compared with 488 in 1948-49 wholly or mainly engaged in manufacture of milk products—of the latter number 331 were butter and milk-products factories, 103 cheese factories, 54 ice-cream factories. The greater number of factories making butter are concerned only or almost wholly with butter, but a variety of products combinations exist at a large number of the factories listed as butter factories—for example, in addition to butter manufacture, the making of powdered-milk products (the major part of Australian production of such), ice-cream and ice-cream mixture (the former to minor

extent and the latter to major extent, as compared with output by specialist manufacturers of ice-cream), ice (to minor extent compared with specialist iceworks), cheese (in considerable quantity), butter concentrate (one factory only), dried butter-fat (several factories), canned butter (several factories). Several large milk-products factories are engaged only in one or more milk products such as condensed milk, concentrated milk, powdered milk, infant and invalid foods. The cheese factories in nearly all instances confine their activities to green cheese, and some have developed to being specialists in certain types of brand-name cheese. Green-cheese factories are operated by most of the seven manufacturers of processed cheese, an activity mainly located in metropolitan areas and largely specialist; however, one of the largest cheese processors has butter factories, and is also considerably engaged in preparation and packing of foodstuffs such as fish pastes, canned meat (and canned cheese), vegetable extract, beef extract, sandwich spreads, relishes, mayonnaise, etc. Ice-cream factories in metropolitan areas are mainly specialist; others are also engaged in ice-making and refrigeration storage. Numbers of dairy-products establishments by employment size in 1948-49 were as follows—

EMPLOYMENT SIZE OF FACTORIES:	Establishments employing:					Total Establishments
	Up to 10	11- 20	21- 50	51- 100	Over 100	
	no.	no.	no.	no.	no.	no.
Butter factories, condensed, concentrated, and dried-milk factories	130	102	67	18	14	331
Cheese factories	72	20	9	1	1	103
Ice-cream factories	29	8	12	2	3	54

The butter, etc., establishments of the 21-50 group collectively employed 2,068 persons, and the more-than-50 group 4,602 persons, out of the activity total of 8,999 persons. The cheese factories in the not-more-than-20 group collectively employed 587 persons out of the activity total of 1,043 persons. The more-than-50 employees group of ice-cream factories collectively employed 779 persons out of the activity total of 1,377 persons.

EGG PROCESSING AND PACKING IN SHELL: The Australian Egg Board controls the distribution by export of eggs in shell and processed eggs. Each State has an Egg Marketing Board which receives eggs from producers, and each arranges the distribution and utilisation of such eggs. The South Australian Egg Marketing Board is a producer of dried egg and sugared dried-egg (sugared dried-egg is a product consisting of dried egg-pulp to which sugar has been added and containing 33 per cent. of sugar (sucrose) in the dried product), it also packs eggs in shell, but does not pulp eggs. The New South Wales Egg Marketing Board also produces dried whole egg and dried egg yolk. The New South Wales, Victorian, Queensland and Western Australian Egg Marketing Boards all pulp eggs and pack eggs in shell for local and export trade. The Tasmanian Egg Marketing Board is not a large pulp manufacturer, but it packs whole eggs for local and export markets. In most of the States, a few companies act as agents for their respective Egg Boards and pack eggs in shell, and in some cases manufacture frozen liquid-egg.

ICE AND REFRIGERATION

Ice making.

Refrigeration of foodstuffs.

Quick-freezing of foodstuffs.

In 1949-50 there were 589 establishments compared with 592 in 1948-49, widespread throughout Australia, wholly or mainly engaged in icemaking and/or refrigeration of foodstuffs. Of the 1948-49 establishments, 499 each employed up to 10 persons (mostly being small iceworks only), 41 each employed from 11 to 20 persons, 28 each from 21 to 50 persons, 12 each from 51 to 100 persons, 12 each more than 100 persons; the not-more-than-20 group collectively employed 2,322 persons, and the more-than-50 group 3,382 persons, out of the activity total of 6,574 persons. Some of the establishments are associated with ice-cream manufacture, butter factories, meatworks. Quick-freezing (deep freezing) is a small but expanding activity (about 20 establishments) treating many types of perishable foodstuffs. One large airways company, in which the Commonwealth Government is a shareholder, quick-freezes all the food used in its catering services.

to 20 persons, 28 each from 21 to 50 persons, 12 each from 51 to 100 persons, 12 each more than 100 persons; the not-more-than-20 group collectively employed 2,322 persons, and the more-than-50 group 3,382 persons, out of the activity total of 6,574 persons. Some of the establishments are associated with ice-cream manufacture, butter factories, meatworks. Quick-freezing (deep freezing) is a small but expanding activity (about 20 establishments) treating many types of perishable foodstuffs. One large airways company, in which the Commonwealth Government is a shareholder, quick-freezes all the food used in its catering services.

BAKING AND PREPARATION OF

Bread.	} Often associated activities.	In 1949-50 there were 3,056 bakeries and 70 biscuit factories compared with 2,950 and 61 respectively in 1948-49 widespread throughout Australia, wholly or mainly engaged in baking. Most bakeries of bread, cakes and pastry are small enterprises, mainly specialising in either bread baking or pastrycook work, but often combining those activities, particularly in country towns; bakeries specialising in block and sponge cake, or pies and pasties, or ice-cream cones and wafers, and so on, are mainly situated in metropolitan areas. (Ice-cream wafers are made to a minor extent in confectionery works. Canning companies are responsible for much of the pudding production in Australia.) The following table shows bakeries and biscuit factories grouped according to employment size during 1948-49—
Cake, pastry, buns, puddings.		
Pies and pasties.		
Biscuits (sometimes also cakes, pastry, pies, puddings).	}	
Dog biscuits.		
Ice-cream cones and wafers.		
Uncooked prepared pastry.		
Motzos.		

EMPLOYMENT SIZE OF FACTORIES:	Establishments employing:					Total Establishments
	Up to 10	11- 20	21- 50	51- 100	Over 100	
Bakeries, including cakes and pastry	no. 2,685	no. 186	no. 64	no. 9	no. 6	no. 2,950
Biscuits	15	16	14	6	10	61

The not-more-than-20 group of bakeries collectively employed 13,393 persons out of the activity total of 17,713 persons, and the more-than-50 group collectively employed 2,444 persons. The ten biscuit factories of the over-100 group employed 3,004 persons out of the activity total of 4,320 persons.

CONFECTIONERY

Chocolate, chocolate coverture, chocolate dipping.	} In 1949-50 there were 275 establishments compared with 263 in 1948-49 engaged in confectionery manufacture. Of the 1948-49 establishments, 149 each employed up to 10 persons, 48 each from 11 to 20 persons, 39 each from 21 to 50 persons, 14 each from 51 to 100 persons, and 13 each more than 100 persons; the latter 13 establishments collectively employed 3,883 persons out of the activity total of 7,539 persons, and the not-more-than-20 group collectively employed 1,417 persons. A small number of the very large confectionery factories, of which MacRobertson's Pty. Ltd.,
Cocoa and potable chocolate.	
Boiled-sugar and other non-chocolate sweets.	
Cake decorations.	
Icing sugar.	
Christmas crackers, Easter novelties, and other novelties.	
Crystallised fruits.	

Nestle's Food Specialities (Aust.) Ltd. and Cadbury, Fry, Pascall Pty. Ltd. are notable, make a range of chocolate lines, including blocks, tablets, machine-dipped and hand-dipped sweets, and also a range of boiled-sugar sweets. Eleven factories make block chocolate; three of these factories supply coverture to the trade, and most chocolate works make cocoa and/or potable chocolate. Several larger factories make boiled-sugar and other non-chocolate sweets, but not chocolate or chocolate sweets. Most of these factories make special lines of confectionery around which the bulk of their trading is conducted. A large number of smaller confectionery factories make a small range of products. Hand dipping of chocolates is a small-scale specialised activity; a few of the manufacturers so engaged have retail establishments specialising in their own products. Icing sugar, cake decorations, Christmas crackers, Easter novelties, malted-milk powder, cordials, and crystallised fruits are also produced in confectionery factories, as well as in other establishments specialising in these lines.

FRUIT AND VEGETABLE WASTE UTILISATION: Two establishments, making fertiliser from fruit and vegetable waste from market and domestic garbage sources. Both establishments are in Sydney; one is a company solely engaged in the activity, the other is a municipal council with a small trial plant.

THE BEVERAGES INDUSTRIES

NON-ALCOHOLIC

Aerated (carbonated) waters.	} In 1949-50 there were 593 establishments compared with 583 in 1948-49, widespread throughout Australia, engaged wholly or mainly in manufacture of aerated waters and cordials. Of the 1948-49 establishments, 476 each employed up to 10 persons, 65 each from 11 to 20 persons, 27 each from 21 to 50 persons, 9 each from 51 to 100 persons, and 6 each more than 100 persons. Establishments of the not-more-than-20 group collectively employed 2,805 persons out of the activity total of 5,029 persons; the 15 largest establishments collectively employed 1,344 persons. Aerated waters make up the greater part of output in this field.
Cordials and syrups— Pure fruit juices. Essence, flavoured. Imitation.	
Brewed non-alcoholic beer.	

FOOD AND REFRIGERATION, ANIMAL FOOD, BEVERAGES, TOBACCO

Natural fruit juices, all kinds, are mainly expressed in fruit-growing districts, and as a co-product and direct product at fruit-processing factories; a few companies produce only fruit juices.

ALCOHOLIC

Brewed (ale, stout, lager, pilsner): In 1949-50 there were 30 breweries compared with 32 in 1948-49. Of the 1948-49 establishments 2 each employed only two persons, 3 each employed from 11 to 20 persons, 7 each from 21 to 50 persons, 7 each from 51 to 100 persons, and 13 each more than 100 persons; the latter 13 establishments collectively employed 4,212 persons out of the activity total of 5,016 persons. It is understood that only 26 of the above breweries are operating, the other 6 being mainly holding companies. Some breweries make aerated waters for supply, in particular, to hotels and other licensed premises owned or served by them.

Wine (unfortified and fortified), Brandy, Fortifying Spirit, Whisky, Gin, Rum Liqueurs (and non-potable Alcohol): In 1949-50 there were 146 establishments classified in official statistics as being engaged wholly or mainly either in "distilling" or in "winemaking" (see Part Three, "Basic Statistics", of this chapter). In 1948-49, there were 146 establishments of which 91 each employed up to 10 persons, 25 each from 11 to 20 persons, 18 each from 21 to 50 persons, and 12 each more than 50 persons. The latter 12 establishments employed 847 persons out of the total of 2,172 persons employed in distilleries and wineries. The more-than-20 group employed 1,435 persons; the not-more-than-20 group employed 737 persons. Distillers making spirit from grain or molasses are separate from distilleries making spirit from wine or lees of wine, but the wine distilleries are frequently associated with winemaking, both unfortified and fortified.

(The Excise Branch of the Dept. of Trade and Customs states that, at 1952, "general distilling licences" issued for distilling of spirit from any material applied to 21 premises; "wine-distilling licences" to distil spirit from wine or lees of wine for own use or for sale applied to 40 premises; "vigneron licences" to distil spirit from wine or lees of wine for the sole purpose of fortifying only the wine sold by the vigneron applied to 24 premises; and "wine-manufacturing warehouse licences" for the manufacturing, including blending, of wine applied to 160 premises. This is a total of 245 premises licensed within the distilling and winemaking activities (one licence to each premises). Some producers have more than one licence of one type, and some also have licences of more than one type. Further, in many instances, two licences apply to one "multiple" establishment—for example, a wine distiller also operating as a wine-manufacturing warehouse (a wine-making vineyard comes within the definition of "warehouse"). In addition, specific licences to make liqueurs, including blending only where the spirit required is not also made, are issued to cover several premises in Australia in which the activity is carried on. The licensing systems under the Excise Act and Distilling Act do not apply to the manufacture of dry wines—that is, wine in which fermentation has been allowed to take its full course, and no fortifying spirit is added at any stage.)

About 20 wine distilleries make brandy, 14 of the brandy distilleries being in South Australia. Fortifying spirit can be made at 85 distilleries (including vigneron), and most make fortifying spirit. Whisky is made at 6 distilleries, 3 of which also make gin. Another 2 distilleries make gin, one of these also making a range of liqueurs. Rum is made at four distilleries (three in Queensland, close to sugar-growing districts, and one at Sydney, at a sugar refinery). Liqueurs are made by about 15 manufacturers, mainly blenders who do not make the base spirit. Methylated spirit is mainly supplied by four distilleries, two of which also make rum (one of these also making power-alcohol, the only producer of such in Australia), the other two being sugar refineries belonging to the one company. (Several companies have licences to methylate spirit, mainly for own requirements, but tend to purchase it from the main suppliers.) White spirit (S.V.R.), used as a base for liqueurs, essences, perfumes, etc., is made by a few distillers, including distillers using molasses, and a whisky manufacturer.

(During the 1939-45 War, the Commonwealth Government erected four distilleries in wheat-terminal areas for production of power-alcohol from wheat. These distilleries have been dismantled and the plant sold for other use.)

Cider and Perry: In 1949-50 there were 7 manufacturers compared with 6 in 1948-49. Of the latter number, three were in Victoria and three in Tasmania. In 1948-49 one employed 27 persons, and the other five collectively employed 23 persons. Cider is the principal product; very little perry is made, and it is not marketed commercially. One manufacturer is marketing an aerated beverage based on concentrated cider.

BOTTLING OF BEVERAGES

Bottling unassociated with component manufacture: In 1949-50 there were 71 establishments compared with 70 in 1948-49 wholly or mainly engaged in bottling of beverages. Of the 1948-49 establishments, 28 each employed up to 10 persons, 12 each from 11 to 20 persons, 25 each from 21 to 50 persons, and 5 each from 51 to 100 persons; the 30 largest establishments (the more-than-20 group) collectively employed 1,115 persons out of the activity total of 1,438 persons. Many winemaking companies operate metropolitan cellars at which bulk wines and brandy are bottled. To minor extent, bulk wines are also bottled by licensed wholesalers and retail merchants. Spirits, including imported spirits, are bottled to a considerable extent at bond stores. District franchise bottling and distribution of carbonated beverages by bottlers not making base syrups is extending in Australia (but the greater part of compounding and bottling is done by the larger, centralised companies making their own base syrups).

Spa-water bottling: By several companies, at the source of supply of natural mineral waters.

THE TOBACCO INDUSTRY

Fine-cut Tobacco, Flake-cut Tobacco, Plug Tobacco, Cigarettes, Cigars, Snuff: In 1949-50 there were 37 establishments wholly or mainly engaged in manufacture of tobacco products in Australia. Of these establishments, in 1948-49, 8 each employed up to 10 persons, 7 each from 11 to 20 persons, 8 each from 21 to 50 persons, 2 each from 51 to 100 persons, and 14 each more than 100 persons, the latter 14 establishments collectively employed 4,708 persons out of the activity total of 5,279 persons. Five companies operate 11 tobacco products factories and employ about 90 per cent. of all persons engaged in manufacture of tobacco products in Australia. One very large company, The British-Australasian Tobacco Co. Pty. Ltd., originally established in Australia under the aegis of United Kingdom and United States interests, but now principally Australian owned and controlled, handles more than half of present total production of tobacco products in Australia. Most firms manufacture a range of products, but there are a few companies wholly engaged in cigar making. (About 13 per cent. of the total leaf used in Australian factories is Australian grown.)

Part Two: Outline of Capacity of Manufacturing Activities

THE manufacture of food, beverages and tobacco products constitutes a major group of activities in Australia—value of output for 1948-49 of establishments wholly or mainly engaged in such activities was £344 million, and for 1949-50 was £389 million, constituting about 23 per cent. of the value of the total Australian output in manufacturing industries in 1949-50.

THE FOOD INDUSTRIES, AND REFRIGERATION

It is estimated that by 1960 the population of Australia will have increased to about 10.5 million, that is, some 25 per cent. increase on present population. In order to maintain exports at recent levels and provide for the augmented population, it is estimated that the necessary increases in production over the 1946-47/1949-50 averages will be—

Beef and veal	40 per cent.
Mutton	58 " "
Lamb	23 " "

Pigmeats	78	"	"
Eggs	31	"	"
Sugar	28	"	"
Citrus fruits	61	"	"
Dried grapes	15	"	"
Whole and dried milk	37	"	"

Whether or not Australia's natural resources will permit all the necessary expansions is a question not within the scope of this survey, but on the other hand, it is obvious that great opportunities will exist in these industries.

MILLING AND ASSOCIATED PROCESSING

Milling and processing activities are strongly established, and, except for a few foodstuffs and derivatives, there is adequate processing capacity to meet Australian requirements and present export demands. Practically all tonnage of grain, pulse and other raw materials used, is grown in Australia (some pulse is imported from New Zealand, but Australia exports more pulse than she imports).

Wheat and oats are Australia's two most important grain crops so far as area under cultivation and quantity of production are concerned. The area sown for wheat has decreased over recent years, while that for oats has remained fairly constant; the yield has, on the other hand, increased as is shown in the following table—

ACREAGE AND YIELD:

	WHEAT		OATS	
	Area Sown for Grain	Yield	Area Sown for Grain	Yield
	mill.acres	mill.bushels	mill.acres	mill. bushels
1938-39	14.35	155.37	1.78	15.55
1946-47	13.18	117.26	1.73	15.57
1947-48	13.88	220.12	2.11	40.70
1948-49	12.58	190.70	1.77	23.60
1949-50	12.24	218.22	1.75	27.39
1950-51 (a)	11.71	188.57	(b)	(b)

(a) estimated.

(b) not available.

Wheaten FLOUR production in 1948-49 was 1,699,265 short tons (worth about £26 million) of which 52 per cent. was exported. Production decreased to 1,509,023 tons in 1949-50, however the production for 1950-51 and 1951-52 at about 1,689,000 tons shows a return to almost the 1948-49 level. Production of WHEATMEAL for baking in 1949-50 was 44,218 tons, 1,419 tons of granulated (for porridge), and 5,222 tons for stock feed; about 3,919 tons of wheatmeal were exported. SEMOLINA production was 13,750 tons of which 12,333 tons were exported. Production of PREPARED BREAKFAST FOODS from wheat was 21,770 tons; exports of breakfast foods other than of oatmeal, rolled oats, semolina and wheatmeal, were quite small—about 290 tons.

The output of SELF-RAISING FLOUR in 1949-50 was 55,660 tons, of which 32 per cent. was produced elsewhere than in flour and grain mills proper; the quantity exported is not available. MACARONI, VERMICELLI and SPAGHETTI output was 6,265 tons, of which nearly 1,254 tons were exported.

Nearly 7,000 tons of EDIBLE WHEAT STARCH were produced in 1948-49, and in 1949-50, 7,673 tons.

No published statistics are available concerning Australian production, imports and exports of GLUTEN, a co-product obtained during manufacture of starch from wheat flour. There are twelve known manufacturers of gluten in Australia.

There are two manufacturers of DEXTROSE in Australia. The principal manufacturer is one of the largest makers of infant-food in Australia, and uses its output of dextrose for a proprietary product. The other manufacturer, who has only recently begun making dextrose, is a subsidiary manufacturing company of the largest pharmaceuticals company in Australia. (A company engaged in the manufacture of cereal products has announced its intention to make dextrose.) Wheat starch is the source material used by the two manufacturers. Output is not known. Users of dextrose in Australia, who are not manufacturers of the product, have difficulty in obtaining supplies. It appears from trade information that there would be a demand for more than 1,000 tons of dextrose a year in Australia. It has been stated that considerable quantities could be sold as a bread improver, although its price may be too expensive for this purpose, and as an ingredient in the manufacture of other pharmaceutical and food products.

GLUCOSE, which is regarded by the trade as the partial hydrolysis product of polysaccharides—chiefly wheaten starch, has been made by one large manufacturer of cereal products for general sale, while one or two other companies have made it for their own

use and for sale to the trade. Two further companies, both processors of cereal products, are understood to have production plans well in hand, so that Australia may become self-sufficient in glucose supplies in the near future. Consumption of glucose by the confectionery industry in Australia in 1948-49 was 8,276 tons, valued at £553,840, while the jam, fruit and vegetable canning industry used 80 tons, valued at £5,200. Corresponding consumption figures for 1949-50 were 10,349 tons valued at £659,544 and 106 tons valued at £7,450 respectively. Statistics on import and export of glucose do not distinguish it sufficiently from dextrose, so that an estimate of Australia's deficiency of either product is not possible from that source.

In 1949-50, the area sown to maize was 193,591 acres which produced 5,995,753 bushels of grain. There has been a marked decline from pre-war, when, in 1938-39, 324,146 acres were sown to produce 7,056,000 bushels of maize. Maize-products manufacture in Australia is relatively a small-scale activity; the quantity of maize used for milling in 1949-50 was 1,247,500 bushels. Output of CORNFLOUR was 5,310 tons (880 tons exported) and of MAIZE MEAL 9,400 tons (exports not known). Output of PREPARED BREAKFAST FOOD made from maize by the two manufacturers of such in Australia is not published, but it is believed to be substantial.

Rice mills in Australia have milling capacity for 250,000 tons a year, but RICE processed by the mills is about 45,000 tons a year. A project is under way to close down all rice mills situated on the seaboard, in favour of two or three mills each having a productive capacity of 50,000 tons a year, situated in the rice-growing areas. A total milling capacity of 150,000 tons is well in excess of crop expectations for many years to come, the extent of rice planting being strictly controlled by a committee of representatives of the State Government of New South Wales (the only State in which rice is grown in Australia) and the growers. Area sown in 1948-49 was 33,000 acres, and yield was 2.7 million bushels. The quantity of rice processed in Australia (in all mills) in 1948-49 was 44,000 tons of paddy and 1,350 tons of cleaned rice. CLEANED RICE produced was 33,600 tons, also 2,100 tons of RICE MEAL and 450 tons of RICE FLOUR. In 1949-50, 3,098 tons of rice meal and 460 tons of rice flour were produced. A recent survey of north-western Australia showed that there are very considerable potential areas, especially on the Fitzroy and Ord rivers, suitable for rice growing. A small quantity of breakfast food prepared from rice is made in Australia by one company specialising in manufacture of breakfast foods of various types.

Output of products derived from oats, rye, barley and pulse is generally in excess of internal demand and the balance is exported.

Grain and pulse are usually available in sufficient quantity for milling needs. OATMEAL production in 1949-50, including rolled and crushed oats, was 24,800 tons (8,365 tons were exported); PEARL BARLEY, 3,250 tons, of which 840 tons of both pearl and Scotch were exported; PEA MEAL 962 tons; SPLIT PEAS 5,264 tons, of which 1,520 tons were exported. Production of RYE FLOUR is thought to be about 100 tons.

Only one manufacturer of POTATO STARCH (also called FARINA) is known, a small company with a single, specialist factory situated in a large, regular potato-growing area, but drawing supplies from other areas as well as from the local area. Production has been spasmodic according to supply of suitably priced cull-potatoes. The quantity produced is not known, and is estimated to be at least 500 tons a year below Australia's present annual requirements. The quantity imported is not known. A considerable export market is available for surplus production should such occur. POTATO FLOUR is not made in Australia. A stock food made from the bran is to be made by the manufacturer of potato starch.

Output of INEDIBLE STARCH of various origin in 1949-50 was a little more than 4,000 tons.

Export of starches in 1948-49 totalled 716 tons, and in 1949-50, 380 tons, and of starch flour, about 7 tons and $\frac{1}{2}$ ton respectively. Imports in 1949-50 of starches were 5 tons, and of starch flours 133 tons, mainly from Malaya and British Borneo.

ARROWROOT is grown on the Queensland coast south of Brisbane. Production of flour has receded from an all-time high of 1,100 tons in 1942 to 300 tons in 1949, the decline being attributed to labour shortages. Arrowroot tubers are delivered to small mills in eleven centres in the growing area and the flour must, by statute, be delivered to the Queensland Arrowroot Board for disposal on a quota basis, mainly to glue manufacturers. Following a recent increase in price, demand for arrowroot flour has recently slackened off and the prospects for expansion of the use of arrowroot industrially are uncertain. However, a modern factory for arrowroot processing has just been built, and a new harvesting device invented and these innovations may help to stabilise the industry. There is a possibility that arrowroot production may develop on the Atherton Tableland in Queensland.

There appears to be an opportunity in Australia for the growing of SOYA-BEAN and production of soya-bean products, but cultivation hitherto has been disappointing. Imports are not known, not being separately recorded. It is considered to be an uneconomic crop as compared with other crops which can be grown under the same conditions, for example navy beans and peas.

SUGAR AND BY-PRODUCTS

Sugar-cane is grown along a 1,300-mile coastal belt extending from Port Douglas in northern Queensland to the Clarence River in northern New South Wales, but about 80 per cent. of the crop is grown from Mackay (Queensland) northwards. There are thirty-five mills throughout the cane-growing belt, three of which are in New South Wales. These three mills and four others in Queens-

land are owned by The Colonial Sugar Refining Company Ltd., which operates a refinery in each of the five mainland capital cities. Two other mills are owned by a smaller refining company, Millaquin Sugar Company Ltd. at Bundaberg, Queensland, while of the remaining twenty-six mills, eleven are owned by public or private companies and fifteen are cane-growers' co-operatives.

The Queensland Government controls the Australian sugar industry on behalf of the Commonwealth Government, through a succession of five-year agreements whereby Australian-grown sugar is protected, when necessary, by an embargo on imports. In return for this protection, the industry is obliged to maintain efficiency and make refined sugar available to all capital cities at a fixed wholesale price. Moreover, the industry must also contribute a sum which is disbursed to Australian manufacturers of specific fruit products for local consumption, that is, the domestic sugar rebate. An export sugar rebate is also payable on the sugar content of all exported sugar-containing products, in order to reduce the sugar contained therein to world-parity price. Since 1942, however, there has been little call for the export sugar rebate owing to world-parity price being in excess of the Australian price.

At the request of cane-growers and millers, a statutory limit is placed on acreage planted with cane (and hence on sugar production) in order to guard against overproduction. The acreage so assigned is based on estimated demand for sugar, both local and overseas. Actual sugar production is, of course, affected considerably by seasonal conditions which may reduce the exportable surplus.

Australian raw sugar production in 1948 and 1949 was about 900,000 tons, of which some 404,608 tons were exported in 1948-49 and 426,413 tons in 1949-50. Production in 1949-50 was 937,120 tons. A recent agreement with the United Kingdom will raise the export quota to 600,000 tons, so that the production assignment up to 1953 will total about 1 million

tons. Average production in the period 1936-40 was about 800,000 tons, but this was reduced somewhat during war and immediate post-war years, due to labour shortages and bad seasons.

About 50 per cent. of the total refined sugar sold in Australia at present is used by manufacturers of food products.

Occasional shortages of refined sugar occur, due mainly to industrial troubles, shortages of labour, and coal. Sugar for export is chiefly in the raw state except for exports of refined sugar to Pacific Islands. The quantity of refined sugar exported in 1948-49 was 10,586 tons, while in 1949-50 only 6,290 tons were shipped from Australia.

By-product MOLASSES finds its chief outlet as a raw material for industrial alcohol and rum production, with smaller quantities being used for stock food, fertilisers and fuel. In 1948 and 1949 molasses production was about 33 million gallons a year. Production figures on treacle and golden syrup are not published.

The final BAGASSE from the raw sugar mills is customarily burnt in the mill furnaces, but some is used for the production of a wall-board with insulating properties. Sugarcane wax is also produced to a limited extent from filter-press mud by one independent company; the wax resembles carnauba-wax in some of its properties and extension of its manufacture is worthy of detailed attention.

BEET SUGAR production has been carried on intermittently in Victoria for over a half century. Peak production of 5,701 tons of beet sugar occurred in 1932-33, but the factory was finally sold for other purposes in 1949.

MALTING

Manufacturing of MALT in Australia is firmly established, but production is not equal to demand. Production in 1948-49 was almost 5 million bushels of barley malt and 161,000 bushels of wheat malt; in 1949-50 it increased to 5.4 million bushels and 174,872 bushels respectively. The Australian breweries consumed 4.8 million bushels (£2,840,000) in 1949-50; the distilleries about 400,000 bushels (£200,000); and pickles, sauces and condiments

manufacture, including vinegar and yeast, 194,195 bushels (£109,475). Malt was not exported in 1948-49, but in 1949-50, 1,067 centals were shipped from Australia; imports were 5,601 centals in 1948-49 and 39,253 centals in 1949-50. MALT EXTRACT is made in Australia by a few manufacturers specialising in its production; exports in 1948-49 were 16,000 lb., and in 1949-50, 9,675 lb., and imports were 13,850 lb. and 24,752 lb. respectively.

STOCK FOODS

Stock foods of vegetable origin are produced extensively in Australia. The productive capacity is sufficient to meet demand, but there are shortages of wheat offal from time to time due chiefly to excess of demand over the amount of offal produced in wheat milling. Current shortages arise from a reduction in flour production—about 200,000 tons less flour were produced in 1949-50 than in 1948-49. Offal produced in 1948-49 was 318,000 tons of WHEATEN BRAN, 354,000 tons of WHEATEN POLLARD and 8,100 tons of SHARPS and SCREENINGS, compared with 273,336 tons, 316,795 tons and 8,666 tons respectively in

1949-50. Exports of bran, pollard, sharps and wheat germ (mainly sharps) were 10,700 tons in 1949-50.

In 1948-49, the area sown to hay crops was 1.5 million acres, which produced 2.2 million tons of hay. In 1949-50, the area was increased slightly to 1.6 million acres, which produced 2.4 million tons of hay. CHAFF production in 1948-49 was 163,600 tons. Imports were negligible and exports were small—2,350 tons of hay and chaff in 1948-49 and 4,577 tons in 1949-50.

CRUSHED GRAIN production in 1948-49 was 14,918 tons.

PREPARED STOCK FOODS

Prepared stock foods are made in Australia by a number of manufacturers. Some of these manufacturers are essentially flour millers using a portion of wheat offal mixed with other grains or protein products to produce balanced foods. Some stock foods are produced by other grain processors such as rolled-oats millers, breakfast-food manufacturers, chaff-

cutters, and others with similar activities. A few milk processors also produce stock foods and use by-products such as skim-milk powder and whey as base materials. Other manufacturers of stock foods include companies which are essentially oil-expressors; these produce linseed cake or nuts, cotton-seed cake and so on. Some of the manufacturers produce a

large range of bird foods and animal foods, sold under brand names and guaranteed standards.

Stock-food manufacturing is a large business in Australia and appears to be developing

FRUIT AND VEGETABLE PROCESSING, AND GROCERY PREPARATIONS

The Australian fruit and vegetable-processing industry and, to a lesser but substantial extent, the grocery-preparations industry are export industries, with manufacturing capacity greatly in excess of internal demand. War-time needs greatly expanded most food-processing capacity in Australia, particularly canning capacity which in some lines is still greater than production needs. Nevertheless, expansion continues in food processing as the population rapidly increases, and internal and export demands remain high.

Canned fruit is now readily available on the Australian market, supply being adequate to local and export demand which has eased somewhat lately.

An unsatisfied market exists for CONCENTRATED JUICES of citrus fruit and passion-fruit, having at least a 4-to-1 concentration. One manufacturer has begun in a small way to make concentrated citrus juice. (Concentrated juice is made by partly dehydrating under high vacuum—the juice is then canned.)

The demand for PECTIN in Australia is increasing and is not being met by production in Australia. Imports in 1948-49 were 28,800 lb. (£15,200), compared with 62,000 lb. (£43,300) in 1949-50. One manufacturer had been making a liquid pectin from citrus peel since 1943; however, production from this source has now ceased. In addition to Australian requirements of pectin, a ready market for high-grade pectin exists in the United Kingdom. Exports of Australian pectin in 1948-49 and 1949-50 were 668 lb. (£300) and 3,200 lb. (£3,520).

Processing, preserving and packing from a plentiful supply of fruit and vegetables is naturally a well-established activity in Australia. About 140 establishments are entirely or mainly CANNERS (some also packing in bottles and jars) and process for either JAM, CONSERVES, JELLIES, or for FRUIT IN LIQUID, or VEGETABLES IN LIQUID, or for PULPS and JUICES or SOUPS, many establishments combining most of these activities, some establishments all activities.

Many food canners have enlarged their plants since the end of the 1939-45 War, and other expansion programmes have been announced. Some of the latter include the building of large-scale modern factories in the Gippsland area of Victoria by at least four previously established companies. With the established food processors and the known expansion programmes within this section of the industry, there appears to be sufficient productive capacity for present requirements. (For production and exports see below.)

soundly. However, there seems to be scope for more expansion, especially where use of other industries' by-products can be utilised. (For veterinary products see Chapter 6, "Chemical and Associated Industries".)

Tinplate and containers, which were previously in short supply, are now in good supply.

New areas for cultivation of vegetables are coming into production on irrigated settlements and higher-rainfall districts, mainly in the south-eastern part of the mainland and in Tasmania.

DEHYDRATED FRUIT (not including sun-dried vine and tree fruits) is produced mainly at small specialist establishments, about sixty in number; a small quantity is also produced by a few canneries. POTATO CRISPS are made in adequate quantity by several specialists. CULINARY HERBS are dehydrated by a few processors. Substantial quantities of DEHYDRATED VEGETABLES—potato, beet-root, cabbage, carrot, onion and swede-turnip—were produced during the 1939-45 War, but relatively little production is now carried on. Export of dehydrated vegetables was considerable in the immediate post-war years, consisting mainly of unused war-time stocks. However, the trade fell away quickly, and in 1948-49 consisted of about 20,000 lb. of dried or concentrated potato and 3,600 cwt. of other vegetables, "dried, dry-salted, concentrated, compressed or powdered", to a total value of £32,000.

SUN-DRIED VINE AND TREE FRUITS are packed in Australia mainly at co-operative and proprietary packing sheds in the growing areas; a small quantity is packed elsewhere, usually in special packs, often with almonds or other nuts. Australia consumes about 25,000 tons of dried vine-fruits at present and exports as much as 65,000 tons in an average good-crop year. Average annual production of dried tree-fruits is about 5,000 tons, most of which is sold in Australia.

Nearly 300 establishments are entirely or mainly producing, in various combinations of products, SAUCES, PICKLES, CHUTNEYS, DRESSINGS, SOUPS, or VINEGAR, YEAST, or GROCERY PREPARATIONS. There is considerable overlapping of activity between the canning group and the "pickles, sauces" group in processing of fruit and vegetables. The degree of interactivity is best shown by the following table which indicates the quantity of principal fruit and vegetable items produced in 1948-49 by the two broad groups, and by other establishments incidentally engaged in fruit and vegetable processing. The table also shows total production for each major group of products in 1949-50.

PRODUCTION:	Jam, Fruit and Vegetable Canning Factories 1948-49	Pickles, Sauces, Condiments, Coffee, Spices, Factories 1948-49	Other Factories 1948-49	Total Australian Production 1948-49	Total Australian Production 1949-50
FRUIT PRODUCTS—	lb.	lb.	lb.	lb.	lb.
Jams, conserves, fruit, jellies	124,285,346	7,052,404	1,613,721	132,951,471	134,577,101
Fruit preserved in liquid	164,893,514	1,752,757	—	166,646,271	188,977,259
Pie apple	18,881,561	—	—	18,881,561	16,366,249
Apple Sauce	2,194,948	—	—	2,194,948	2,555,055
Baked style whole	—	—	—	—	57,842
Fruit pulp—					
Consumed in own works	13,742,063	795,872	446,208	14,984,144	10,342,416
For sale or stock	28,147,504	521,360	1,091,888	29,760,752	31,628,912
Dehydrated fruit, all kinds (but not sun- dried)	126,388	—	2,723,772	2,850,160	1,269,381
Crystallised fruit	523,337	222,396	439,323	1,185,056	2,631,824
Candied peel	1,371,682	—	511,072	1,882,754	3,465,494
Fruit juices, natural—	gal.	gal.	gal.	gal.	gal.
Pineapple	251,861	—	3,132	254,993	929,024
Citrus	16,953	476,095	286,091	493,048	523,718
Other	127,970	134,389	131,086	262,359	209,949
CORDIALS AND SYRUPS—	gal.	gal.	gal.	gal.	gal.
Pure fruit juice	338,545	97,425	2,292,706	2,728,676	2,696,936
Flavoured	63,034	26,704	1,187,365	1,277,103	1,249,874
Imitation	11,852	21,508	273,434	306,794	383,609
Flavouring essences	(a)	54,462	174,145	228,607	577,450
VEGETABLE PRODUCTS—	lb.	lb.	lb.	lb.	lb.
Vegetables preserved in liquid	41,540,329	6,998,591	2,814,600	51,353,520	66,756,205
Tomato pulp—					
Consumed in own works	16,384,032	14,172,256	—	30,556,288	29,307,280
For sale or stock	24,439,184	8,417,696	470,400	33,327,280	43,864,800
Tomato juice	1,099,826	512,876	226,112	1,838,814	741,995
Tomato soup	1,855,244	2,440,660	—	4,295,904	2,677,710
Tomato sauce	1,457,574	1,686,615	82,928	3,227,117	3,102,218
Chutney	198,952	143,561	—	342,513	269,679
Pickles	141,550	916,461	—	1,058,011	1,178,432
Soup other than tomato	764,204	181,429	—	945,633	1,298,720
Sauces—					
Worcester	11,277	590,290	9,809	611,376	701,398
Other	19,472	179,538	131	199,141	233,863
Vinegar	141,996	3,087,632	88,212	3,317,840	3,382,802

(a) Not available for publication.

In 1949-50 exports of jam, conserves and jellies represented 48 per cent. (65.2 million lb.) of the total quantity made in Australia in the same period; exports of canned fruit and vegetables represented 45 per cent. (130.5 million lb.); of pickles, sauces, chutney, 5 per cent. (2 million pints); of peanut butter, 25 per cent. (.9 million lb.). Imports in 1949-50 of jams and jellies were 30,164 lb. (clearances for 1950-51, 51,740 lb.) and of pickles, sauces, chutneys, olives, capers, 109,619 gallons.

The manufacture and/or packing in Australia of dry and liquid GROCERY PREPARATIONS (spices, pepper, curry powders, mustard, ginger, baking and custard powders, saline powder, jelly crystals, self-raising flour, pre-mixed pastry, scone and cake mixtures, domestic flavouring essences, and similar products) is largely carried out by manufacturers often referred to as "manufacturing grocers", some of which are large-sized old-established companies. (Several of these manufacturers are also large, general millers of "dry-goods".) Substantial quantities of certain types of grocery preparations are also made collectively, in establishments mainly concerned with sauces, pickles, chutney, and so on. Production of principal preparations in 1949-50 in all factories was 0.9 million lb. of baking powder; 7.1 million lb. of custard powder (9 per cent. of which was exported); 1.3 million lb. of saline powder; 1.1 million cwt. of self-raising flour (31 per cent. of which was made in flour and grain mills proper); 13.9 million lb. of jelly crystals, and jelly powders (of which 632,342 lb. was exported); 3.7 million lb. of peanut butter and

paste (25 per cent. of which was exported); 61.0 million lb. of icing sugar (a little less than half of which was made in confectionery factories); 490,525 lb. of curry; 1.2 million lb. of ground and preserved ginger; 647,564 lb. of mustard; 427,927 lb. of pepper; 391,412 lb. of spices. The production of grocers' sundries is sufficient to supply local demand and to supply a small export trade.

MONOSODIUM GLUTAMATE is now produced in both liquid and solid forms by one firm which processes cereals. There have been imports from Japan and elsewhere, but figures are not published.

Before the 1939-45 War all MUSTARD consumed in Australia was imported, either in seed for grinding in Australia, or as prepared mustard, mainly the latter. When war-time restrictions closed overseas sources of supply, the commercial growing of mustard was begun in Australia, with the result that, since 1946, enough seed has been harvested to meet the requirements of the Australian market, and also allow for export of seed, ground mustard, and mustard preparations. In all cases, the mustard grown is under contract with one company, which is the only grinder of Australian-grown mustard-seed, marketing its product under a world-famous brand-name. Exports of Australian produced ground mustard, including French mustard, were 8,661 lb. (seed exported was 503,146 lb., mainly to the United Kingdom). Imports in 1949-50 of ground mustard, including French mustard, were 19,224 lb. (and of seed 306,007 lb., mainly from New Zealand).

Blending and packing of TEA, and blending, processing and packing of COFFEE are mainly carried out by a few large tea and coffee-importing warehouses, and several manufacturers of grocery preparations. Coffee and tea are not grown commercially in Australia, but a beginning has been made with tea growing in Queensland and New Guinea on an experimental scale. Imports of tea in 1949-50 were 54.7 million lb. valued at £11.8 million, compared with 42.6 million lb. valued at £8.1 million in 1948-49. Of the 1949-50 imports Ceylon supplied 34.9 million lb., India 17.4 million lb., and China 336,236 lb. Imports of coffee, raw and kiln-dried, were 8.4 million lb. valued at £963,610 in 1949-50, compared with 7.26 million lb. valued at £498,000 in 1948-49. Of the 1949-50 imports Uganda Protectorate supplied 1.0 mil-

lion lb., Brazil 5.3 million lb. and Kenya 422,125 lb. Factory production of coffee products in 1949-50 was 5.5 million lb. Small quantities of raw and kiln-dried coffee, and raw and kiln-dried chicory were exported, but principally exports were in the form of roasted and ground coffee and chicory in liquid form, or mixed with milk or other substance—340,000 lb.

FLAVOURING ESSENCES, FRUIT EXTRACTS and COLOURS, for confectionery, cordials and food processing, are mainly produced in Australia by a small number of specialised manufacturers. In 1949-50, 557,450 gallons of flavouring essences were produced of which, however, three-quarters were made elsewhere than in food-processing factories. (See Chapter 6, "Chemicals and Associated Industries".)

YEAST

Manufacture of BAKER'S YEAST is firmly established in Australia, by four firms in Victoria and three in New South Wales. One large producer plans to begin manufacture in Queensland. Production is kept up to internal and export demand. Some yeast producers also make vinegar. In 1949-50 production was 20.3

million lb. of yeast, of which 216,000 lb. was dried yeast; and 3.3 million gallons of vinegar. In 1949-50 imports of yeast totalled 134,290 lb. Exports of yeast were 258,500 lb., and of vinegar 37,700 gallons. YEAST EXTRACT is made by two manufacturers in Australia, and the market is adequately supplied.

MEAT PROCESSING AND PRESERVING, AND BY-PRODUCTS TREATMENT

The husbandry of sheep and cattle in Australia in numbers in excess of local meat requirements led, many years ago, to the establishment of a large and widespread meat-export industry. However, consumption of meat by Australia's rapidly increasing population is expanding faster than is the raising of herds and flocks; the ratio of fresh meat used to meat preserved or exported as carcase meat will steadily rise, unless the growing of stock increases at a faster rate than it is at present. A leading meat packer and carcase exporter recently stated that, within ten years, Australia will no longer be a meat-exporting country of significance. However, the situation was unusually affected by the high wool prices of 1950-51.

Stock numbers at March, 1949, were not significantly different from those of ten to fifteen years ago, as shown by the following table—

STOCK NUMBERS:	Average 5 Years 1934-35/1938-39	1949	1951
	million	million	million
Cattle	13.48	14.13	15.2
Sheep	111.32	108.74	115.6
Pigs	1.18	1.20	1.1

Meat production (bone-in weight) and exports of carcase meat in 1949-50 were—

PRODUCTION AND EXPORTS:	Percentage of Exports to Production		
	Production	Exports	Production
	tons	tons	
Beef and Veal	606,522	81,908	13.5
Mutton	205,839	31,135	15.1
Lamb	152,294	55,066	36.1
Pork	34,958	6,685	19.1
Bacon and ham (cured weight)	40,603	2,499	6.1

The capacity of the meat-preserving and meat-canning industry expanded considerably to meet additional requirements of Allied Services' demands during the 1939-45 War, with the result that there is now adequate capacity to process all available canning and preserving meats for internal and export markets. The industry is in a position to expand further if needed. CANNED-MEAT production was, in 1949-50, 128.6 million lb. and in 1950-51, 126.1

million lb. The 1949-50 production included 69.3 million lb. of beef, 2.3 million lb. of rabbit, 7.4 million lb. of mutton, 9.9 million lb. of meat and vegetables, and 3.4 million lb. of bacon and ham. Exports of canned meats, meat and vegetables, and soup, in 1949-50 were 113.0 million lb.; 56.6 million lb. was of beef, and 17.6 million lb. of meat and vegetables. Imports of canned meats into Australia during the same period were 472,500 lb.; of cured hams and bacon, 4,850 lb.; and potted or concentrated meats (including extracts, meat jellies and soup powders), 62,545 lb. Some expansion is planned for processing and canning RABBITS and POULTRY to meet an overseas market; figures of production and export of canned poultry are not published.

AGAR AGAR is not now made in Australia. Two manufacturers who were engaged in its production during and since the 1939-45 War, using locally-produced seaweeds, have recently ceased production owing to inability to compete with imported agar agar. Research has revealed that Australia has raw material available for about 100 tons of agar agar a year and a market within Australia for about 50 to 75 tons a year.

ALGINATES are not produced in Australia, although vast fields of suitable seaweeds are available off the Tasmania coast.

MEAT DEHYDRATION was carried out during the 1939-45 War, but production has now ceased.

SMALLGOODS output in 1948-49 was valued at £2.6 million (quantity not recorded), mainly produced in specialist smallgoods factories, meat works and ham and bacon factories. KOSHER MEATS are produced in the fresh state, in smallgoods and canned, some of the canned output being exported. Output of MEAT EXTRACTS AND PASTES was 4.58 million lb. in 1948-49, and 2.3 million lb. in 1949-50.

Production of FATS in 1949-50 totalled 214 million lb. (95,500 tons), consisting of EDIBLE FATS, 79.4 million lb., about one-third of

which was dripping; LARD, 5.4 million lb.; RAW TALLOW 83.1 million lb.; and REFINED TALLOW 46.9 million lb. Exports were 6.1 million lb. of edible fats other than tallow (205,393 lb. of lard, 1.5 million lb. of dripping, and 4.4 million lb. of other edible fats), 6.6 million lb. of edible tallow, and 38.9 million lb. of inedible fats. Total exports of fats were 23,170 tons, representing 20 per cent. of the production. The export of tallow from Australia is controlled by statutory provision to ensure that Australian demands for tallow are met; an export levy on tallow and tallow products (for example, soap) is utilised to subsidise and keep down the internal price to users in Australia.

SAUSAGE-CASING manufacture in Australia is well established, very competitive and well related to material supply and markets. The supply of casings from Australian meat-works in 1949-50 was 48,270 cwt. of beef casings, 37,290 cwt. of mutton and lamb casings, and 5,510 cwt. of pig casings. Imports were 8,813 cwt., mainly of hog casings and including synthetic casings. The exports from Australia of casings during the same period were 26,688 cwt., mainly of sheep casings. Manufacturing of GUT for racquet strings and certain industrial purposes is carried out to the limit of supply of suitable casings. Much competition for casings takes place between the gut and sausage-casing manufacturers; both branches are at present under-supplied with raw materials.

RENNET is processed in Australia, but production is insufficient to meet the demands of local cheesemakers and other users. It is understood that all countries which produce rennet, excepting New Zealand, are not meeting requirements. One large United Kingdom manufacturer recently formed an Australian company for production of junket tablets and other milk products. However, present plans for this company are in abeyance.

MEAT-MEAL and FISH-MEAL for poultry and stock food are not manufactured in sufficient quantity for Australia's increasing requirements. It is reliably stated that double the present production of meals could be readily consumed. Production of meat-meal is to

the limit of available offal, and in 1949-50 was 724,754 cwt.; output of whale meat meal should increase considerably from the two whaling shore-stations recently established in Western Australia. Processing of fish-offal for fish-meal began recently, and will be extended when full-scale use of heads and bodies of cray-fish is made, the tails of which are quick-frozen mainly for oversea markets.

PANCREATIC GLANDS and OTHER GLANDS are forwarded for treatment for insulin manufacture and for other products, to the Commonwealth Serum Laboratories in Melbourne. All beef and some sheep pancreas and other glands are treated in this laboratory; sheep pancreas have been exported to the United States of America, but this export is now restricted. Before export is sanctioned permission must be sought from the Director General of Health.

Production of BLOOD-AND-BONE FERTILISER in 1949-50 was 452,834 cwt. Australian requirements are not being met, but production is to the limit of available material. Very little blood-and-bone fertilisers are exported.

The GELATINE industry is a key industry. It originated as a by-product of the meat industry, drawing raw materials from meat works, abattoirs, tanneries and fellmongeries. Supplies of raw material are subject to seasonal fluctuation and contingencies beyond control of the supplier. The industry absorbs the whole of the raw material available in Australia and it is now necessary to import from overseas additional quantities. In 1949-50 the value of raw material purchased exceeded £250,000. Gelatine falls within two main classifications, edible and technical. Edible gelatine is required to conform with the Pure Food Acts of Australia and it is prepared in a range of standardised grades to meet industrial specialisation. The production of edible gelatine (and technical gelatine) requires the highest level of scientific control throughout. Prior to the 1939-45 War it was customary to export an appreciable portion of production, but with the rapid growth of demand, the exportable surplus has diminished. The industry meets the demand of Australia's secondary industries.

FISH PROCESSING AND PRESERVING

The fish supply in Australia is not as prolific as that enjoyed by many Northern Hemisphere countries, due to natural limitations, but there is considerable room for expansion in certain sections of the industry. Demersal fishing and fishing for a few species of pelagic fish have been practised for many years, but in the past two years an important development in pelagic fishing has occurred with the establishment of tuna fishing off the "South Coast" of New South Wales. It is expected that tuna fishing will be developed around the southern half of Australia, and in Western Australian and Tasmanian waters. Attention has also been paid to the possibility of a pilchard fishery both for canning and for production of meal. All fishing is subject to such regulations as the various States may enforce in the interests of conservation, but legislation is proposed to enable the Commonwealth to give effect to conservation and development in extra-territorial waters.

The greater part of the development of FISH CANNING in Australia occurred during and since the 1939-45 War. It will be seen, how-

ever, from figures quoted below that a drop in production has occurred over the past few years. This is attributable to the fact that hitherto some 80 per cent. of the fish canned in Australia has been barracouta and salmon (about 40 per cent. of each), which are not considered to be as suitable for canning as pink salmon, pilchards, tuna and herrings. In consequence, present production is less than canning capacity, which was built up to meet service and immediate post-war export demands. However, if the tuna and pilchard industries develop in line with recent successful tests, there should be a greatly increased demand for these higher-quality canned products. Production of processed and canned fish in Australia in 1948-49 was 10.89 million lb. of canned fish, 542,000 lb. of smoked fish, and 724,000 lb. of fish pastes, while in 1949-50 production was 8.6 million lb., 946,000 lb. and 1.0 million lb. respectively. Production of canned fish dropped to 7.2 million lb. in 1950-51. Thus 1949-50 production from Australian fish canneries was about 20 per cent. less than that of the previous year, while in 1950-51, it was 30 per cent. less.

Exports of fish products in 1948-49 were 4.6 million lb. of canned fish, 194,500 lb. of potted or concentrated fish, and 21,000 lb. of canned shell fish compared with 2.3 million lb., 17,986 lb. and 33,807 lb. respectively for 1949-50. Imports in 1949-50 were 17.17 million lb. of canned fish, 213,660 lb. of potted or concentrated fish, 980,624 lb. of other fish including salted, and 296,445 of canned crustaceans and shell fish. Imported fish consists mainly of sardines, herrings, kippers, and smoked cod. Pre-war, red and pink salmon was a principal item, but it is now small because salmon imports are mainly from hard-currency areas.

Two organisations have recently begun WHALING operations in Western Australia. One is the Commonwealth Government's Australian Whaling Commission and the other a public company. The former plans to produce 4,500 tons of whale oil, 3,000 tons of meat and bone, and 6,000 tons of whale solubles. In the 1951 season it treated 650 whales. The public company in its first two seasons, 1949 and 1950,

treated 190 and 347 whales respectively, and in 1951, 574. As a result of the 1951 operations by the two companies over 9,000 tons of whale oil will be exported, mainly to Europe.

The processing of SHARK-LIVERS for production of an oil rich in vitamin A was a war-time industry of considerable extent, but the return of other imported vitamin-A oils from overseas, coupled with overseas developments in synthesising vitamin A, will probably curtail the demand for Australian shark-liver oil except for veterinary emulsions.

Export of CRAYFISH TAILS in 1949-50 was 2,650,245 lb., and of whole crayfish 93,366 lb. Of the total export of 2,743,611 lb. of crayfish, 96 per cent. was exported to the United States of America; this trade has increased considerably over the past two years.

Production of OYSTERS and SCALLOPS and subsequent processing by bottling, chilling, deep freezing, are well-established branches of the industry.

MARGARINE

The production of INDUSTRIAL MARGARINE has increased recently, being 416,000 cwt. in 1949, and 491,400 cwt. in 1950, mainly because of the greater use of industrial margarine in manufacturing cakes and pastries by retailers and/or factories. Production of TABLE MARGARINE has decreased during the same period from 170,000 cwt. to 125,000 cwt. The output of table margarine in Australia is strictly controlled by statute in all States, and is on a quota basis for local consumption. A moderate quantity of table margarine is exported. Fats used by the margarine industry were 59.3 million lb. of animal

fat and 13.1 million lb. of vegetable fat; oils used were 47,281 gallons of animal oil, 2.8 million gallons of refined coconut oil, 174,476 gallons of peanut oil and 125,970 gallons of other oils. The import of margarine into Australia is prohibited. Exports in 1948-49 were 13.2 million lb., of which both Poland and Italy were large purchasers. In 1949-50, only 9.1 million lb. were exported.

Edible fats other than margarine, and stearine, are also produced by the margarine industry. STEARINE production in 1949-50 totalled 103,862 cwt. in all.

MILK PRODUCTS

Australia had, at March 1949, 4.86 million dairy cattle, of which 2.33 million were in milk. At March, 1951, the total was 4.8 million, with 2.25 million in milk. The production of milk on farms for all purposes during 1950-51 was estimated at 1,199.2 million gallons. This was lower than output during 1949-50 by 42.1 million gallons, or by 3.4 per cent., but was 10.5 million gallons or 0.9 per cent. higher than in 1938-39. No significant increase in production of milk is expected for the next two or three years, when increased efficiency in management combined with irrigation may achieve this result.

There is an annual surplus of most dairy products for export and the industry is therefore dependent on overseas markets for maintenance of its status.

There are several schemes in force aimed at stabilising the industry, and these function on a guaranteed price based on estimated cost of production of butter and cheese. In recent years, revenue from overseas sales has exceeded the guaranteed price and the difference is paid into a stabilisation fund which will be drawn upon should export revenue fall; more recently stabilisation payments have ceased due to the approximation of overseas and the guaranteed price. The balance of the revenue from overseas sales and from local sales is equalised (voluntary equalisation scheme) and if that figure is below the guaranteed price, the Commonwealth makes good the difference by subsidy. A similar scheme applies to processed milk products, except that no equalisation arrangement is in force. These

schemes have undoubtedly benefited the industry. In addition, the Commonwealth has sought to promote improved dairy-farming practices by a Dairy Industry Efficiency Grant.

Under a seven-year contract, until 1954-55, all the Australian exportable surplus of butter and cheese goes to the United Kingdom apart from small, mainly token, quantities for export to other selected countries.

Australia's production of milk for the years 1948-49, 1949-50 and 1950-51 was 1,212 million gallons, 1,241 million gallons and 1,199 million gallons respectively. The utilisation of milk has been fairly constant over the period 1947-50 and is shown by the 1949-50 statistics—990 million gallons of milk (about 80 per cent.) was used for manufacturing milk products in butter, cheese, condensed milk, concentrated milk and powdered milk factories—806 million gallons for butter, 96 million gallons for cheese, 88 million gallons for condensed, dried and other milk products. Production and exports for 1949-50 were as follows—

PRODUCTION AND EXPORTS:	Production 1949-50 tons	Percentage	
		Exports 1949-50 tons	Exported 1949-50
Butter	168,445	81,394	48
Cheese (unprocessed)	44,777	22,948	52
Condensed milk	49,767	32,302	48
Concentrated milk	17,270		
Powdered milk—			
Full cream	22,539	10,654	47
Skim	9,279	8,514	91
Buttermilk and whey	3,103	—	—
Infants' and milk foods, malted milk, milk sugar	10,282	6,782	66
Casein	3,566	710	20

Milk-products factories in 1949-50 also made 263,530 gallons of ice-cream, 13.4 million lb. of ice-cream mixture, and 77,879 tons of ice. Total 1949-50 production of butter was 173,559 tons. The 5,114 tons not made in butter factories was farm butter—29 million gallons of milk were used in its production. Cheesemaking on farms is negligible, being about 42 tons in 1948-49 and 20 tons in 1949-50.

At least seven new large companies, six of which have overseas interests, are establishing factories in Australia for production of preserved-milk products, other than butter and cheese. One very large American company has registered an Australian company to manufacture powdered milk for export, and has purchased two existing butter and cheese factories.

In addition to the trend towards greater processing of whole milk, consolidation of butter factories has been steadily proceeding. Larger companies are absorbing smaller companies, centralising plant, and closing down the smaller factories. The trend is the result of higher costs of modern plant and better transport facilities for longer haulage from farms. Consolidation of butter factories is expected to continue for some time to come.

Whilst the number of "butter" factories has sharply declined since 1938-39, the number of employees in butter factories has increased 38 per cent. since then, and butter production has, in the same period, declined by about 17 per cent. This effect comes about because many factories, primarily concerned with butter production, are now making powdered milk from whole and skim milk, and are now collectively responsible for the greater part of production of those products in Australia.

Production of table margarine for local consumption is limited by statute in Australia to 3,900 tons a year (namely about one lb. per head of population or about 4 per cent. of current butter consumption). The difference in the present subsidised price of butter, and the price of table margarine, is so small that margarine does not compete with butter to any marked degree. Industrial margarine is now being used in greater quantities in factories for production of pastry and cakes.

There have been marked changes also in the utilisation of milk in Australia over the past decade, and notably a reduction in the proportion of milk used for butter production. Thus, in the three-year period, 1936-39, 78 per cent. of total milk production was used for butter-making, while in the years 1947-50, the proportion fell to 65 per cent. On the other hand, there has been a rise in the proportion of milk used as fluid milk, and for cheese and preserved-milk products—condensed milk, concentrated whole milk, dried full-cream milk, dried buttermilk and whey, infants' and invalids' foods.

The output of preserved-milk products in 1938-39 was 29,705 tons; in succeeding years there was a remarkable increase and by 1950-51 the total quantity of preserved-milk products was 104,421 tons. Over this period, the production of condensed milk increased by 32,944 tons, or 212 per cent., and of powdered milk (full cream and skim) by 13,692 tons, or 128 per cent. The total production of preserved-milk products recorded in 1950-51 was lower by 7,819 tons, or 7 per cent., than 1949-50 production.

Indications are that after the cessation of butter rationing in June, 1950, local consumption of BUTTER per capita approached its pre-war level, temporarily offsetting the tendency towards greater proportional usage of milk in other products. However, since consumption of fluid milk is probably the dominant factor and will undoubtedly increase with increasing population, it appears that the exportable surplus of milk products will necessarily decrease. This consideration will not affect the production of residual dairy products, such as dried skim milk, buttermilk, whey and casein, which have shown considerably increased production over the past decade.

Production details for the years 1938-39, 1949-50, 1950-51 are as follows—

PRODUCTION:	1938-39	1949-50	1950-51 (b)
	'000 gals.	'000 gals.	'000 gals.
Milk produced . . .	1,189,174	1,253,533	1,201,753
	tons	tons	tons
Butter produced . . .	203,500	168,445	159,865
Cheese produced . . .	29,304	44,777	44,557
Condensed milk . . .	15,519	49,767	48,463
Concentrated whole milk	1,659	17,270	18,142
Dried full-cream milk	10,712	22,539	18,501
Dried skim milk . . . (a)		9,279	5,903
Dried buttermilk and whey	566	3,103	2,955
Infants' and invalids' food (including malted milk and milk sugar)	1,259	10,282	10,457
Casein	2,592	3,566	3,943

(a) Not available, but believed small.

(b) Subject to revision.

Other than processed CHEESE, Australian production is confined to a few main types comprising roughly 98 per cent. cheddar and the balance Edam, Gruyere, Roman and blue-vein types. About half of the total quantity of cheese produced in Australia is made in Victorian factories.

From production figures for cheese, it is apparent that almost a half million tons of WHEY annually must have been available as a by-product in recent years, which is equivalent to some 34,000 tons of dried whey. Similarly some 17,000 tons of dried buttermilk and 330,000 tons of dried skim milk are the annual equivalent of recent butter production. Thus only a small fraction of the residues from butter-making and cheese-making are being dried, and much is still being fed to stock, which in general, consume about 10 lb. of milk protein to produce 1 lb. of less-digestible meat protein.

The consolidation of butter factories, and the growing practice of separating milk at the factory, rather than on the farm, will undoubtedly tend to promote processing of butter residues, but this is offset in part by the rising costs of collection, precondensing, and drying. SKIM MILK is dried by both roller and spray drying; production of the latter exceeds that of roller-dried and commands a premium of about £20 per ton. Research is proceeding on the addition of dried skim-milk to Australian bread.

LACTIC and RENNET CASEIN are both made in Australia, and production has increased steadily over the last five years. Of the 3,800 tons (equivalent to about 15,000 tons of dried skim-milk) produced in 1949-50, 710 tons were exported.

There is only one LACTOSE producer (a butter factory) in Australia, the whole production of which is purchased by the Commonwealth Serum Laboratories; the quantity of lactose produced is not published. All other users of lactose are at present short supplied; the quantity secured from imports being insufficient; 1948-49 imports were 650,273 lb. valued at £38,408, and in 1949-50, 1,268,968 lb. valued at £70,577, mainly from New Zealand.

Production of ICE-CREAM in 1948-49 was 14.5 million gallons, and in 1949-50, 15.5 million gallons, compared with 4.2 million gallons in 1938-39. Of the 1948-49 total, a small

quantity, 128,000 gallons, was made in butter factories, which, however, made 14.9 million lb. of ice-cream mixture for sale to ice-cream manufacturers and for their own limited use; this quantity of mixture is estimated to be nearly one-fifth of the total mixture used in ice-cream manufacture in Australia. Established companies have extended to cope with the demand, and a major ice-cream manufacturing company of New Zealand has recently established and is now manufacturing ice-cream in Australia. Some of the larger ice-cream manufacturers also produce cones and wafers for sale to retailers and/or their own use.

EGG PACKING AND PROCESSING

Egg production in 1949-50, on a commercial scale, totalled about 107 million dozen. Commercial poultry farming and packing of eggs in Australia are controlled by statutory State Marketing Boards. The eggs upon production are vested in the State Boards, whose responsibility it is to market such eggs and return the proceeds thereof, less marketing charges, to the producers.

All State Boards endeavour to sell the greatest possible proportion of the egg production on the local market and have the facilities for the grading, processing and packing of the commodity, both for local and export sale. Surpluses above immediate local requirements are either pulped for sale to pastrycooks on a long-term contract basis or, where of suitable quality, are packed for export in shell or for export in pulp or powdered form. By far the greater proportion of eggs and egg products exported are sold to the United Kingdom under a contract existing between the Governments of Australia and that country. Arrangements for the shipping and financing of these exports to the United Kingdom, apart from the physical handling of the eggs, are made by the Australian Egg Board which purchases from the State Boards that portion of the exportable surplus which is allocated for despatch to the United Kingdom.

Exports of eggs and egg products to destinations other than the United Kingdom are effected under licence from the Australian Egg Board.

During the period of 1st June to 30th November the export target each season up to and including the season 1952-53, is 105 million dozen, in all forms, but preference for supply of, first, eggs in shell; second, liquid whole-egg (egg pulp); third, sugared dried-egg; fourth, dried whole-egg. This contract with the United Kingdom is expected to bring stability to egg production, but supply and price of foodstuffs for poultry feeding are continuing problems (see Prepared Stock Foods, earlier in this section).

Of the 1948-49 commercial production of eggs, about 37 per cent. was exported—19.6 million dozen as eggs in shell; 27.04 million lb. of egg-yolk or egg-albumen or both, combined in liquid form; 8,680 lb. as dried egg-albumen; 32,064 lb. as dried egg-yolk; and 2.1 million lb. of dried yolk and albumen combined. Established processing capacity is adequate for internal and export needs. In 1949, Australia was the largest single exporter of eggs (all forms) to the United Kingdom, 38 per cent. of its total imports of eggs coming from Australia. Of the 1949-50 commercial production of 107 million dozen eggs, exports were 23.0 million dozen eggs in shell, 16.8 million lb. of egg-yolk or egg-albumen or both, combined in liquid form; 6,832 lb. as dried egg-albumen; and 794,761 lb. as dried yolk and albumen combined.

ICE AND REFRIGERATION

The manufacture of ICE, FOODSTUFFS REFRIGERATION, and REFRIGERATED STORAGE, are all well-established activities throughout Australia.

QUICK-FREEZING is a new branch of food-processing in Australia. Some large food manufacturers are now engaged in quick-freezing, and present production includes processed fruits, vegetables, fish, crayfish tails, scallops, and prepared cooked meals for domestic use and for catering generally, or, for domestic use, for catering services in the hotel and restaurant trade and on international airways. The greatest immediate development

is in the packing of certain perishable foodstuffs for export markets. Present production of quick-frozen products is being absorbed locally and overseas, but the industry should expand and assume greater importance in the future.

Greater consumption of quick-frozen products within Australia will be largely dependent upon greater installations of storage units throughout retailers' stores, in addition to ordinary refrigeration, and greater co-operation from the primary producers in providing suitable varieties of fruits and vegetables in fresh condition for quick freezing.

BAKING OF BREAD, CAKES, BISCUITS AND SIMILAR ACTIVITIES

Production of BREAD in 1948-49 in Australia was the equivalent of 560.5 million 2-lb. loaves valued at £14.3 million, and in 1949-50, 596.8 million 2-lb. loaves valued at £16.2 million.

The bread industry in Australia, consisting of many establishments, shows considerable

variation as to size and efficiency of bakeries. In metropolitan areas, some of the larger bakeries are fully mechanised, or nearly so, and some are substantially mechanised; a few bakeries have wrapping plant in conjunction with slicing machines, for sale of wrapped, sliced bread, but machine-wrapping of bread

is negligible in Australia. Most bakeries, city and country, while not mechanised, use items of machinery such as mixers, dividers, provers, moulders and so on.

Many bakeries are financially bound to flour-mill companies, which exert a powerful influence on the baking trade. Although a number of bakeries are financed by such milling companies there is usually no legal binding on them to buy flour from that mill. During the 1939-45 War, various exigencies forced the rationalisation of the breadmaking industry, and the Commonwealth Government, by means of Orders based on the National Security Act, regulated the baking industry in all capital cities and in many important provincial areas. This regulation was achieved by licensing bakers, allotting each a zone for bread deliveries conducted by bakeries, and also by limiting the variations of bread which could be baked. After the War, these controls were relinquished, but, as zoning is so much to the interests of bakers already established, it has been continued "unofficially". Consequently, a substantial measure of zoning still exists, and any infringement of the trade arrangements results in retaliatory action by bakers involved. It will be seen, therefore, that some difficulty will necessarily confront a newcomer in the baking trade, in any area which is already served by bakers with established connections, unless an existing business is purchased.

One large Canadian company has established in Australia, and purchased the largest mechanised bakery in Sydney, three large South Australian bakeries, one large Melbourne bakery, and a controlling interest in another large bakery in Melbourne.

Greater use of dried skim-milk and gluten in fortification of bread could well be made by Australian bakeries, and research on that aspect is being undertaken by a Commonwealth research agency.

Many bread makers in Australia also make CAKES, PASTRY, PIES, PUDDINGS, as an ancillary activity, but the greater quantity produced in Australia is made by specialist bakers in the metropolitan areas and the larger country towns. Output in 1949-50 was valued at £13.5 million (quantity not collected). Some large bakeries in metropolitan areas specialise in block cake for sale through their own retail shops and agencies, in both metropolitan and country areas. Other large bakeries (some directly associated with a cafe or a chain of cafes) bake cakes, pastries, pies and pasties for sale through their own outlets and supply wholesale to retailers. Many retailers have a

cake and pastry bakery attached to or situated within the shop. Pies and pasties are frequently made in association with other pastry goods, but a considerable quantity is made in metropolitan areas by manufacturers who make nothing or little else, and maintain a distributing system to retailers (including factory canteens), throughout the metropolitan area.

Among the sixty manufacturers in Australia engaged mainly in making BISCUITS about fifteen are large-scale producers making a wide variety of biscuits, and, in some instances allied products such as cakes; the remainder specialise in certain lines. Biscuit manufacture in Australia has kept pace with overseas trends, and is therefore modern and efficient, particularly in the large establishments, which produce the greater part of output in Australia. Total output of biscuits (not including ice-cream wafers and cones, or dog biscuits) in 1949-50 was 117.8 million lb. valued at £6.35 million; 4 million lb. was made in factories other than biscuit factories proper. Export of biscuits (of all types) is quite small, being 1.8 million lb. in 1949-50, valued at £101,238, about 1 per cent. of total production. Exports in the immediate post-war period were as high as 20 per cent. of production in the same period; this high trend of export quickly fell away. Imports of biscuits (of all types) are negligible, being 224,000 lb. valued at £24,359 in 1949-50. The imports are mainly high-class biscuits from the United Kingdom.

Output of ICE-CREAM WAFERS and CONES in 1949-50 was 4.1 million lb., of which about 85 per cent. was produced in biscuit factories proper, mainly in factories specialising in such products; the remainder was produced in other factories, including confectionery works. (Three major ice-cream manufacturers make their own wafers and cones—one sells on a national basis, the other two mainly throughout one State each; the latter two companies also make wafers and cones for the trade, one being a major biscuit manufacturer, the other being a major manufacturer of wafers and cones before entering into ice-cream manufacture.) Biscuit factories also make cakes, pastry, pies and puddings, but only to a minor extent, production being in 1949-50, £357,000, about 2 per cent. of the value of total output. Motzos are made in Australia in sufficient quantity for the Australian market; small quantities are exported.

The 1949-50 output of DOG BISCUITS was 3.9 million lb., mainly produced by the biscuit industry proper, but also made in Australia in factories mainly concerned with the preparation of animal and bird foods.

CONFECTIONERY

The manufacture of CONFECTIONERY in Australia has been well established for many years and has developed with every opportunity. The industry has sufficient capacity to meet Australian requirements and permit a modest export trade—exports in 1949-50 were 3.9 million lb., valued at £403,062. Retailers are plentifully stocked with a full variety of sweets, practically all Australian-made, but including some imported sweets—imports being 1,276,733 lb. in 1949-50, valued at £167,095, mainly from the United Kingdom. It appears that the most likely avenue for expansion in the confectionery industry in Australia will occur in the consolidation of existing establishments.

Production of the industry in 1949-50 included 42.9 million lb. of solid block or bar chocolate with or without fruit and/or admixture; 13.2 million lb. of block or bar chocolate with soft or hard centre; 35.7 million lb. of other chocolate confections; 5.2 million lb. of chocolate sold for further manufacturing processes; 5.3 million lb. of cocoa powder and drinking chocolate; 70.7 million lb. of confectionery without chocolate (a small quantity of which was made in factories not mainly concerned with confectionery production); 20,985 tons of icing sugar for sale in addition to stock, as well as 5,200 tons consumed by producers (11,554 tons of icing sugar were also produced

in grocery preparation establishments in 1949-50).

The industry in 1949-50 used 46,243 tons of sugar (including 6,240 tons of icing-sugar of its own processing), and purchased 2,205 tons of icing sugar; consumed 292,374 gallons of fresh whole milk, 60,283 cwt. of condensed milk, 53,902 cwt. of powdered milk; 7,387,632 cwt. of concentrated milk; 5,607 cwt. of butter; 206,991 cwt. of glucose; 23.9 million lb. of cocoa beans, 4.9 million lb. of cocoa butter; 3.1 million lb. of chocolate. The quantities of gelatine, nuts, dried fruit, malt extract, essences, essential oils and vanilla used were not collected by the Statistician in 1949-50; however, in 1948-49 the quantities used were: gelatine 777,000 lb., nuts 35,900 lb., dried fruit 1.0 million lb., malt extract 567,500 lb., essences 87,800 lb., essential oils 189,400 lb., and vanilla 20,500 lb.

The following table shows the substantial increase in production of the confectionery industry in Australia since 1938-39—

PRODUCTION:				Chocolate	Without Chocolate	Cocoa and Chocolate (potable)
				mill.lb.	mill.lb.	mill.lb.
1938-39	..	..	..	43.52	58.15	3.06
1948-49	..	..	..	72.48	68.93	5.39
1949-50	..	..	..	84.01	70.71	5.37

CHEWING-GUM in various forms (other than "bubble-gum") is made in Australia by only two companies, one of which is a branch company of the largest chewing-gum manufacturer in the world. The quantity of chewing-gum made in Australia is not published, nor the quantity, if any, of imports and exports. Manufacturing capacity is understood to be adequate for the Australian market. The basic material, chicle, is all imported, mostly from the United States of America; 1948-49 imports were 2,159 cwt., valued at £54,496; the previous year's imports were 3,713 cwt., valued at £128,773, while in 1949-50 imports fell to 996 cwt. valued at £39,653.

FERTILISER FROM VEGETABLE WASTES

There is an opportunity in Melbourne and probably also in other large Australian cities, where fresh fruits and vegetables are marketed wholesale in great quantities, to utilise for fertiliser the huge bulk of WASTE FRUIT and VEGETABLE MATTER from markets, which at present is being incinerated or used as filling in reclamation areas. A firm using such waste

material for manufacture of fertiliser is operating in Sydney, and one Sydney suburban municipal council and one Western Australian municipal council have small plants for the same purpose; but in other cities there appears to be no use made of garbage of vegetable origin.

THE BEVERAGE INDUSTRIES

AERATED WATERS AND CORDIALS

There has been great expansion of production of "soft drink" in Australia in the past eleven years. Output of AERATED (carbonated) WATERS, including hop beer, ginger beer, bulk waters, was in 1949-50 50.1 million gallons, more than double the production in 1938-39 (23.7 million gallons); of CORDIALS and SYRUPS, 4.3 million gallons—2.6 million gallons of pure fruit based, 1.24 million gallons of flavoured, 383,600 gallons imitation—four times greater than 1938-39 production (998,600 gallons); of NATURAL FRUIT JUICES, 1.6 million gallons—20,643 gallons of apple, 523,050 gallons of citrus, 929,024 gallons of pineapple, 189,306 gallons of other fruit juices—more than four times greater than 1938-39 production (348,600 gallons).

This industry is a substantial consumer of Australian products such as sugar, carbon dioxide, essential oils (especially from the citrus industry), and wooden cases.

Wartime demands considerably expanded plant capacity for fruit-juice production, and led also to the extension and greater use of capacity for production of aerated waters, cordials and syrups. The industry now has ample manufacturing capacity for Australian requirements, and for an export market in excess of present trade. Nevertheless, a newly registered company with Canadian interests recently joined with Australian interests in forming a £2 million company to make "dry" beverages; first production from this company began in January, 1952.

The consumption of non-alcoholic beverages in Australia is no longer confined to warm weather months; they are now to be found in

most households as regular kitchen stock throughout the year, in addition to all industrial canteens, hospital kiosks and school tuck-shops.

Practically all aerated waters and the greater quantity of cordials and syrups produced in Australia are made in factories mainly concerned with such production. In 1948-49 less than 1 per cent. of aerated waters was produced in other factories; but of cordials and syrups, 16 per cent. of pure-fruit based, 7 per cent. of flavoured, and 18 per cent. of imitation, were made in factories other than those mainly concerned with cordials and syrups. Aerated waters and cordial factories also produced in 1948-49 about 60 per cent. (34,750 gallons) of apple juice produced in Australia, about 58 per cent. of citrus juice, about 1 per cent. of pineapple juice, and about 44 per cent. of other pure fruit juices, also small quantities of vinegar, tomato and worcester sauce, and ice.

Imports of fruit juices have been quite small in recent years; however, the 1950-51 Customs' clearances show imports of 111,000 gallons of lime juice. Exports of aerated and mineral waters were substantial in the immediate post-war years, but have fallen back to the negligible pre-war levels. Exports of fruit-juices and syrups have increased substantially since pre-war—in 1949-50, 537,861 gallons of citrus, 82,400 gallons of black-currant, 1.2 million gallons of pineapple, and 296,812 gallons of other fruit juices and syrups, were exported. The supply of fresh fruits to the cordial and fruit juice industry is generally sufficient for requirements; the significance of the cordial industry to the Australian fruit growers is considerable.

BREWING

A steady rise, both in population and in consumption per head of population was responsible for the increase in production of beer, ale, lager and stout in Australia by 73 per cent. between 1938-39 and 1949-50; production is continuing to increase. Total consumption in Australia in 1938-39 was 84.03 million gallons, and the consumption per head of population 12.13 gallons; total consumption in 1949-50 was 146.74 million gallons and per person 17.87 gallons.

Exports were quite small (except in 1945-46, due to unusual post-war circumstances), in 1949-50 being 112,290 gallons in containers of not more than one-gallon capacity, and 76,910 gallons in bulk. Imports were greater than exports in 1949-50, being 1.06 million gallons in containers of not more than one-gallon capacity, and a few gallons in bulk; these imports were mainly bottled ales and stouts from the United Kingdom, and in unusual quantity (despite a price twice that of Australian products) considered to be mostly due to the continuing shortage of bottled ales and stouts in the eastern States of Australia.

Large companies dominate the brewing industry in Australia. Several of the companies also each own a large number of hotels. Production is to the limit of available hops, labour and plant capacity but is not equal to the increasing demand, particularly for bottled beer. The shortage of bottled beer, of which there has been little increase in production over recent years (26.11 million gallons in 1938-39, 29.28 million gallons in 1948-49 and 32.9 million gallons in 1949-50), is due to, according to "the trade": (a) restriction of building and additions to factory premises during and since the war;

(b) a priority, by breweries to publicans, for the supply of bulk beer; (c) shortages of raw materials required for brewing (but not bottles); and in general, breweries are not able to keep pace with the increased consumption of beer.

In 1949-50 the brewing industry used 4.8 million bushels of malt, 3.5 million lb. of hops, and 28,819 tons of sugar. It produced—

PRODUCTION:	1949-50	
	Bulk	Bottled
	gals.	gals.
Ale	99,593,379	18,523,062
Lager	21,640,586	12,332,774
Stout	26,685	2,072,141
Totals	121,260,650	32,927,977

Waste beer totalled 1.9 million gallons.

Excise and Customs duty on beer (mainly Excise) in 1948-49 was £31.98 million and £33.69 million in 1949-50. The Excise rate (June, 1952) is 7/2 a gallon.

Whilst Australia is self-sufficient in grain for maltsters and in malt supply (a modest tonnage is exported each year) and in sugar, it ceased some years ago to grow its full requirements of hops, and in post-war years has not grown sufficient hops to meet its requirements. The greatest quantity of hops is imported from the United States of America, with the remainder from the United Kingdom.

The following table shows the area under hop cultivation in Australia, production and quantity of hops used in Australian breweries, and imports and exports of hops for the years 1938-39, 1947-48, 1948-49, and 1949-50—

AVAILABILITY:	Acreage under hop cultivation in Australia	Production	Quantity of Hops used in Australian Breweries	Imports	Exports
	acres	mill.lb.	mill.lb.	mill.lb.	lb.
1938-39	1,105	2,402	2,351	.175	214
1947-48	1,503	2,739	2,806	1,100	1,682
1948-49	1,530	1,904	3,309	.689	78
1949-50	1,555	1,904	3,612	1,344	20

WINES, BRANDY, WHISKY, RUM, GIN

The WINE industry was begun almost at the dawn of Australian settlement, and after many difficulties various private firms and companies have expanded their activities to become substantial growers, and wine or brandy producers. Later, at Renmark, an irrigation settlement on the Murray River, it was decided to erect a distillery on a co-operative basis, growers to be shareholders and each to subscribe a proportion of the needed capital. The grapes were delivered to the distillery, crushed and fermented into wine which was distilled for its alcoholic content. The spirit obtained was sold to proprietary wineries to be used for fortifying sweet wines. Similar distilleries were erected at other settlements. In all these irrigation areas co-operation has been the keynote of success; the growers and distillers became established along sound lines in conjunction with the co-operative packing and marketing of dried and fresh fruits. The co-operative wineries have brought an era of prosperity to the irrigation settlements in all parts of Australia and with it, the production of wines, brandy, fortifying spirits, and liqueurs has developed to a major industry.

The grape-growing districts in Australia are widely spread and cover an area of about 135,272 acres. South Australia is the most important grape-growing and wine-producing State, accounting for about 73 per cent. of the vintage, followed by New South Wales and Victoria with about 17 and 9 per cent. respectively, while Queensland and Western Australia make up the balance of about 1 per cent.

About thirty large wineries, which mostly own their own vineyards or are co-operative organisations, are now pre-eminent in the industry, but there are also at least 130 other wineries owned by private firms or by small companies.

Sparkling wines are made in Australia by at least four major wineries. The bulk of the sparkling wines produced, which include champagne, hock, burgundy and moselle, are of excellent quality and compare favourably with those produced overseas. The existing manufacturers have sufficient capacity to cater for local and export trade; however, early in 1952, the Australian demand for sparkling wines was greater than the supply being made available

to it. Most sparkling wines produced in Australia are made and sold under the company's own brand name, but one of the manufacturers also bottles for other merchants.

At least two other wineries carbonate wines to produce an aerated product, and one company produces a mixture of wine and beer.

Production of beverage and distillation wines in Australia in 1949-50 was 33.9 million gallons (14.6 million gallons of beverage wines and 19.3 million gallons of distillation wines), as compared with 16.0 million gallons in 1941-42 (7.3 million gallons of beverage wines and 8.6 million gallons of distillation wines). Although the production of wines has increased by about 73 per cent. over this period, the quantity exported has fallen by about 50 per cent. The output of wines in 1948-49 was valued at £6.4 million, and in 1949-50 at £6.9 million.

It was anticipated by the wine industry, when the additional tariff rates of duty were placed on Australian wines imported into the United Kingdom, that the industry would be able to supply far greater quantities of wines than there was a demand for. However, the Australian demand for wines has increased to such proportion (about 14 million gallons in 1950-51 compared with 4.5 million gallons in 1938-39) that there are now indications that the Australian demand will not be satisfied. The average annual consumption of wine was 1.50 gallons per head of population in 1949-50.

Exports of beverage wines, mainly to the United Kingdom, and wines used as ships' stores, totalled 1.1 million liquid gallons in 1949-50, as against 3.7 million liquid gallons in 1938-39. The major factor in this post-war decline in exports is the altered situation in the United Kingdom market. Up to 1939, Australia enjoyed a tariff advantage of 50 per cent. over foreign wines. Now, however, the rate of duty on all wines is higher than pre-war, and the margin of preference on Empire wines is considerably reduced. The duty on fortified Empire wines is now 40/- a gallon compared with 4/- in 1939, and the margin of preference over foreign wines has fallen from 50 per cent. to 20 per cent. Britain's wine imports in 1948-49 were 8.8 million gallons (Australia supplied about 1.3 million gallons), which were about 42 per cent. below imports in 1938.

The rapid expansion of wine exports from Australia from about 1925 onwards showed the necessity for closer supervision and co-ordination of the export trade. The Wine Overseas Marketing Act, was passed in 1929 and provided statutory control over export of wine. In terms of this Act, a Wine Overseas Marketing Board was established, comprising five members representing proprietary and privately-owned wineries and distilleries, one representing the Commonwealth Government and two representing co-operative wineries and distilleries. In 1936 the membership of the Board was increased by the addition of a representative of the grape growers. At the same time the name of the Board was changed to the Australian Wine Board. In 1945, two additional grape growers' representatives were admitted to the Board. Exports of wine from Australia can only be made under licence issued by the Minister for Trade and Customs. All licences are issued subject to the Board's recommendation, and the selling prices, shipment and disposal of wine overseas is made through the Board's London agency. Administrative and other expenses of the Board are financed by

levies on grapes delivered to wineries and distilleries.

The production of BRANDY has increased from 567,678 proof gallons in 1941-42 to 768,302 proof gallons in 1948-49 and 867,353 proof gallons in 1949-50. Exports also increased from 114,467 proof gallons to 133,390 proof gallons in 1948-49, but declined in 1949-50 to 110,169 proof gallons.

Exports of LIQUEURS increased from 558 proof gallons in 1941-42 to 41,195 proof gallons in 1948-49, but declined to 9,588 proof gallons in 1949-50. In 1949-50, 72,209 gallons of liqueurs, valued at £141,543, were produced.

Rum, whisky and gin production are well-established activities in Australia.

RUM is mainly produced in conjunction with the sugar industry in Queensland. In 1949-50, 1.1 million proof gallons were produced, as compared with 793,750 proof gallons in 1941-42. Exports of rum in 1948-49 were 60,448 proof gallons while 16,714 proof gallons were imported. In 1949-50, only 44,373 proof gallons of rum were exported, while imports were 16,771 proof gallons. Even though the 1948-49 level of production of rum was in advance of previous years there is an indication that molasses will be in extremely short supply due to the cane-growers using molasses as a fertiliser. This shortage of molasses will probably be noticed in the future production of rum and industrial alcohol.

Production statistics for WHISKY are not available for publication; however, 62,158 proof gallons were exported in 1948-49 and 220,216 proof gallons (mostly Scotch) imported, while in 1949-50 there were exports of 47,858 proof gallons and imports of 334,587 proof gallons. Only six distilleries are engaged on whisky manufacture in Australia. Concerning whisky production in Australia, the established distilleries are embarking upon expansion programmes, and providing raw materials and power are available the overall production could be greatly increased.

There was a small increase in production of GIN, from 372,930 proof gallons in 1941-42 to 411,493 proof gallons in 1948-49; however, in 1949-50 production dropped to 360,042 proof gallons. Export of gin in 1948-49 was 94,639 proof gallons, a decrease of more than 75,000 proof gallons from the preceding year: in 1949-50 export increased slightly to 129,360 proof gallons. Imports increased by 18,000 proof gallons to 38,590 proof gallons from 1947-48 to 1948-49, and increased to 47,673 proof gallons in 1949-50.

The quantity of Australian brandy, whisky, rum and gin on which Excise duty was paid in 1949 was 2,245,349 gallons, which was the third highest total on record. Greater quantities of Australian brandy, whisky and rum passed into local consumption in 1949, than was the case in the preceding year, but there was a decrease in the quantity of gin taxed for Excise (the quantity of gin taxed in 1949 was greater than production—the surplus being drawn from bonded stocks).

There are some new large areas under cultivation for grapes now coming into bearing or about due to become productive in 1952; these new areas, when in full production, may have the effect of increasing production of wines or brandy, but may also be used for increasing the quantity of dried fruits—the main factor in either instance being the prices paid for grapes

to the growers. Shortages of suitable grains (on a quality basis), malt, sugar and power would appear to be a deterrent to the immediate setting-up of new distilleries in Australia.

The export of wines, spirituous liquors and liqueurs are subject to examination by experts in Australia so that products of inferior quality

are not exported to the detriment of Australia's reputation overseas.

Manufacture of CIDER in Australia is a small-scale activity, mainly confined to Victoria and Tasmania. Production is about 200,000 gallons annually. Small quantities are exported, mainly to Ceylon, and imports are negligible. Commercial production of PERRY ceased many years ago in Australia.

BOTTLING

Bottling of beverages and other liquids in Australia in 1949-50 was carried out by seventy-one establishments. The greatest number of these were companies associated with bottling of wines and spirituous liquors; the bottling being done on licensed premises or bonds situated mostly in metropolitan areas, but sometimes at or near the wineries or distilleries where the products are made. Included within this group are some licensed grocers and/or blenders who purchase liquors from various districts and blend and bottle these liquors according to requirements either for their own retail sale or for sale to the trade.

Bottling of carbonated beverages from compounded essences not made by the bottlers themselves commenced shortly before the 1939-45 War. Immediately after the war, the development of franchised bottling commenced on the basis of larger companies supplying the franchised bottler with the compounded essences from which the bottler built up his

syrops. Two companies with American interests have granted bottling franchises to Australian companies established in main capital cities and some other towns. These franchised bottlers carry out large-scale bottling of well-known beverages originating in America. Some of the cordial makers also produce beverages from syrups purchased from other manufacturers.

Natural spa-waters are bottled by several companies at the source of supply of the mineral waters.

Other liquids such as kerosene, petrol, phenyle and methylated spirits are bottled by numerous companies, mostly concerned with grocers' preparations, polishes, hardware, etc., but only a few small establishments are wholly or mainly engaged in bottling of such liquids and classified as bottling factories. Production of the whole group of bottling companies in 1949-50 was valued at £2.3 million.

THE TOBACCO INDUSTRY

Manufacture of tobacco products in Australia is mainly the concern of five strong separate companies, of which British Tobacco Company (Australia) Limited, with its subsidiaries, is by far the largest producer. A number of smaller companies and one growers' co-operative group are also engaged in manufacturing tobacco products.

During the last few years, the activities of the industry have been curtailed by shortage of labour and shortage of dollars for the purchase of American tobacco-leaf. Sufficient substitutes for American leaf have not been available to bridge the gap. However, the manufacturers have plans for expansion which will be put into operation and if adequate labour and raw materials become available the Australian industry should be able to meet the considerably increasing demands. The gap has been met by imported tobacco products, mostly from the United Kingdom, which are usually about £14 per 100 lb. higher in price than comparable Australian-made products.

Tobacco consumption has risen with the increase both of population and consumption per head of population. In 1938-39 23.11 million lb. was consumed, and consumption per head was 3.33 lb. In 1948-49, eleven years later, total consumption was 34.0 million lb., and the rate per head had risen to 4.36 lb. In 1949-50, 37.8 million lb. was consumed, which represented an increase in the per head rate to 4.7 lb. Customs and Excise duty paid on tobacco consumed was £7.39 million in 1933-39, £34.74 million in 1948-49 and £38.9 million in 1949-50.

The consumption of all tobacco products is increasing, but the increase in the use of each of the three major types is at a different rate, so that the relative ratios of production are

changing. The consumption of cigarettes is rising at a faster rate than is that of fine cut, while the rate for fine cut is, in turn, moving more quickly than that for flake and plug pipe tobaccos.

The industry is heavily dependent upon imported tobacco leaf, both in quality, quantity and type. The Australian supply is small and mainly of qualities of leaf which, though good, are used mainly for blending into the Virginia-type tobacco to which the Australian market has been accustomed and prefers. To encourage greater use of Australian-grown leaf, a Customs rebate is allowed conditional on use of 3 per cent. Australian-grown leaf for cigarettes and 5 per cent. for tobacco (the percentages of leaf are variable according to supply of Australian-grown leaf, but have not been altered for four years). The duty rebate at present is one shilling and eleven pence per lb. off a duty of nine shilling and one penny for cigarette type leaf, and one shilling and six pence per lb. off a duty of six shillings and six pence for tobacco type leaf. Excise, additional to Customs duty, is levied on all manufactured tobacco products irrespective of country of origin of the leaf. Rates of Excise as from September, 1951, were—

TOBACCO—

Tobacco, hand-made strand (a)—

In the manufacture of which all the tobacco leaf used is Australian-grown	per lb.	13s.6d.
Otherwise	per lb.	14s.2d.

(a) "Hand-made Tobacco" shall mean tobacco in the manufacture of which all operations are entirely carried on by hand without the aid of machine tools or machinery other than that used in the pressing of the tobacco.)

Tobacco, manufactured, n.e.i.—	
In the manufacture of which all the tobacco leaf used is Australian-grown	per lb. 13s.9d.
Otherwise	per lb. 14s.5d.
Tobacco, fine cut suitable for the manufacture of cigarettes—	
In the manufacture of which all the tobacco leaf used is Australian-grown	per lb. 25s.2d.
Otherwise	per lb. 25s.10d.
Tobacco, in the manufacture of which all the tobacco leaf used is Australian-grown, for consumption by Australian aborigines, as prescribed by Departmental By-laws	
	per lb. 6s.11d.
CIGARS—	
Hand-made (b)	per lb. 16s.11d.
(b) "Hand-made Cigars" shall mean cigars in the manufacture of which every operation is performed by hand, provided that moulds may be used)	
Machine-made	per lb. 17s.11d.
CIGARETTES , including the weight of the outer portion of each cigarette—	
Hand-made (c)	per lb. 25s.7d.
(c) HAND-MADE CIGARETTES— "Hand-made" shall mean that the whole of the operations connected with the filling and completion of cigarettes shall be performed exclusively by hand.)	
N.E.I.	per lb. 25s.10d.

Tobacco-growing in Australia has had many vicissitudes over the past twenty years, but there are now prospects of sound, steady development. Meantime the proportion of Australian-grown leaf to total leaf used remains lower than pre-war, when it was 22:78 (1938-39); for the three years 1946-47 to 1948-49 the ratio (average) was 12:88, and in 1948-49 it was 16:84.

In Queensland, a tobacco marketing board (a State Government authority) appraises the locally-grown tobacco leaf, it fixes reserves on

the leaf and then sells it by open auction. In Victoria, the leaf is appraised by representatives of the growers and sellers, reserves are fixed and then the leaf is sold in open auction. In Western Australia, the leaf is sold in open auction.

The industry in 1949-50 used in all 27.35 million lb. of stemmed leaf "Strips" as follows—

CONSUMPTION:

	1949-50			
	Tobacco	Cigarette	Cigar	Total
	lb.	lb.	lb.	lb.
Australian leaf	2,797,885	515,160	—	3,313,045
Imported leaf	13,998,501	9,869,462	174,539	24,042,502
Totals	16,796,386	10,384,622	174,539	27,355,547

The industry in 1949-50 produced 3.0 million lb. of plug, 8.7 million lb. of flake-cut, 8.39 million lb. of fine-cut, 169,312 lb. of cigars (19.0 million), 10.3 million lb. of cigarettes (5000 million); and sold 395,809 lb. of refuse, waste and clippings.

The industry was then, and remains at present unable, by a substantial quantity, to meet the demand for tobacco products, mainly because "dollar budgeting" in Australia restricts supply from the United States of America—the principal source of imported leaf. This leaf is distributed among manufacturers on a quota basis.

The small export trade in Australian-made tobacco products, is mainly to nearby countries, much of it being "trade" tobacco. Imports of tobacco products in 1949-50 were 9.08 million lb.—773,772 lb. of manufactured tobacco, 8.27 million lb. of cigarettes, 34,500 lb. of cigars, and 1,027 lb. of snuff; total imports were greater than preceding years, particularly of cigarettes (582,100 lb. in 1946-47, 2.85 million lb. in 1947-48 and 6.68 million lb. in 1948-49).

Part Three: Basic Statistics

COMPARATIVE STATISTICS, 1938-39/1949-50

NUMBER OF ESTABLISHMENTS AT 1938-39 AND 1949-50

NUMBER OF EMPLOYEES AT 1938-39, 1949-50, JUNE 1950, SEPTEMBER 1951

Activity (Statistical Sub-classes used by Commonwealth Statistician, 1949-50)	Establishments		Employees			
	1938-39	1949-50	1938-39	1949-50	June 1950 (a)	Sept. 1951 (a)
	no.	no.	no.	no.	no.	no.
FOOD—						
Flour Milling	172	161	3,783	4,541	4,638	4,752
Cereal Foods and Starch (b) .. .	63	78	2,043	3,485	3,598	3,509
Malting	32	28	530	805	830	921
Arrowroot	(c)	11	(c)	14	(d)	(d)
Sugar Milling	36	35	4,031	(d)	(c) 8,298	(c) 10,095
Sugar Refining	6	6	1,638			
Animal and Bird Foods (f) .. .	25	71	190	762	(d)	(d)
Chaffcutting and Corncrushing .. .	287	189	1,063	808	768	662
Jam, Fruit and Vegetable Canning (g) .. .	(h)79	(h)140	(h)5,281	(h)10,106	(c) 10,542	(c) 8,635
Dehydrated Fruits and Vegetables (j) .. .	36	53	901	1,301		
Condiments, Coffee, Spices (k) .. .	176	230	3,269	4,968	4,695	4,535
Pickles, Sauces, Vinegar (l) .. .	(h)44	(h)57	(h)1,195	(h)2,094	2,072	2,022
Meat and Fish Preserving and Meat Extracts (m) .. .	32	86	4,093	8,552	(c) 9,122	(c) 8,835
Sausage Skins	24	26	597	742		
Boiling Down, Tallow Refining (n) .. .	59	75	884	1,460	(c) 1,484	(c) 1,519
Animal Oils	4	6	160	208		
Bacon Curing	76	86	2,047	2,907	3,009	2,885
Margarine (o)	25	35	651	868	815	743
Butter	(p)410	(p)323	(p)6,073	(p)8,834	(p)8,548	(p)9,395
Cheese	(p)108	(p)99	(p)516	(p)967	(p)1,014	(p)1,070
Condensed, Dried and Processed Milk .. .	(p)5	(p)6	(p)262	(p)668	(p)441	(p)461
Totals for Milk-products Factories, except Ice-Cream .. .	(p)523	(p)428	(p)6,851	(p)10,469	(p)10,003	(p)10,926
Ice Cream	61	53	1,020	1,481	1,154	1,430
Ice and Refrigerating	491	589	4,808	6,429	5,909	5,768
Bakeries (including Cakes and Pastry) .. .	(q)1,958	(q)3,056	(q)11,715	(q)16,091	13,346	13,187
Biscuits	36	70	4,572	4,981	4,828	5,041
Confectionery (including Chocolate and Icing Sugar) .. .	(q) (r)148	(q)275	(q) (r)7,256	(q)8,998	8,978	8,394
Other (of Class LX) (s)	83	132	1,512	(t)11,732	(t)4,029	(t)3,826
Food totals (u)	4,476	5,976	70,701	104,702	98,178	97,685
BEVERAGES—						
Aerated Waters, Cordials, etc. (v) .. .	517	593	2,880	5,250	4,063	4,518
Breweries	34	30	3,698	5,258	5,445	5,656
Distilleries (w)	41	(x)16	362	(x)484	505	577
Wine-making (y)	94	(x)130	771	(x)1,646	1,397	1,355
Cider and Perry	3	7	19	44	45	45
Bottling (z)	45	71	660	1,495	1,373	1,373
Beverages totals (u)	734	847	8,390	14,177	12,828	13,524
TOBACCO—						
Tobacco, Cigars, Cigarettes, Snuff .. .	30	37	5,544	5,167	4,920	5,116
Food, Drink, Tobacco Totals (u) .. .	5,240	6,860	84,635	124,046	115,935	116,325

(Basic Statistics are continued on next page)

STATISTICAL SUMMARY, 1949-50

EMPLOYMENT, MALE AND FEMALE

SALARIES AND WAGES PAID, IN TOTAL AND PER PERSON ENGAGED

VALUE OF PRODUCTION

VALUE OF MATERIALS, POWER, FUEL, REPAIRS, etc. }

See Explanations,
Appendix IV

VALUE OF OUTPUT

Activity (Statistical Sub-classes used by Commonwealth Statistician, 1949-50)	Employment			Salaries and Wages Paid		Value of Pro- duction	Value of Materials, Fuel, etc. Used	Value of Output
	Males	Females	Persons	Total	Per Person Engaged			
	no.	no.	no.	£'000	£	£'000	£'000	£'000
FOOD—								
Flour Milling	4,287	254	4,541	2,349	517	4,277	28,281	32,558
Cereal Foods and Starch (b)	2,266	1,219	3,485	1,427	409	3,171	5,769	8,940
Malting	790	15	805	455	565	924	2,286	3,210
Arrowroot	13	1	14	3	214	15	35	50
Sugar Mills	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)
Sugar Refining								
Animal and Bird Foods (f)	694	68	762	330	433	686	3,414	4,100
Chaffcutting and Corncrushing	775	33	808	269	333	464	1,537	2,001
Jam, Fruit and Vegetable Canning (g) (h)	5,793	4,313	10,106	4,041	400	6,582	14,488	21,070
Dehydrated Fruits and Vegetables (j)	850	451	1,301	490	377	755	651	1,406
Condiments, Coffee, Spices (k)	2,267	2,701	4,968	1,770	356	4,110	8,644	12,754
Pickles, Sauces and Vinegar (l) (h)	1,156	938	2,094	860	411	1,792	3,408	5,200
Meat and Fish Preserving and Meat Extracts (m)	7,013	1,539	8,552	4,165	486	7,200	24,191	31,391
Sausage Skins	700	42	742	392	528	619	615	1,234
Boiling Down, Tallow Refining (n)	1,437	23	1,460	716	490	2,190	2,082	4,272
Animal Oils	189	19	208	133	639	175	288	463
Bacon Curing	2,638	269	2,907	1,318	453	2,283	12,688	14,971
Margarine (o)	757	111	868	391	450	821	3,941	4,762
Butter	(p)	1,470	10,469	4,942	472	8,099	62,102	70,201
Cheese								
Condensed, Dried and Processed Milk	894	587	1,481	621	419	1,851	2,855	4,706
Ice Cream	6,089	340	6,429	3,112	484	4,898	2,975	7,873
Ice and Refrigerating	13,232	3,759	16,991	5,537	326	12,234	17,599	29,833
Bakeries (including Cakes and Pastry) (q)	2,161	2,820	4,981	1,744	350	3,061	3,734	6,795
Biscuits	4,267	4,731	8,998	3,328	370	7,394	11,558	18,952
Confectionery (including Chocolate and Icing Sugar) (q)	10,028	1,704	11,732	5,422	462	9,338	37,621	46,959
Other (of Class IX) (s) (t)								
Food totals (y)	77,295	27,407	104,702	43,815	418	82,939	250,762	333,701
BEVERAGES—								
Aerated Waters, Cordials, etc. (v)	4,436	814	5,250	1,866	355	4,137	5,186	9,323
Breweries	5,098	160	5,258	2,896	550	7,563	8,288	15,851
Distilleries (w) (x)	443	41	484	258	533	683	1,100	1,783
Wine-making (y) (x)	1,540	106	1,646	719	437	1,485	3,645	5,130
Cider and Perry	34	10	44	15	341	30	23	53
Bottling (z)	1,136	359	1,495	668	446	2,370	1,331	3,701
Beverages totals (u)	12,687	1,490	14,177	6,422	453	16,268	19,573	35,841
TOBACCO—								
Tobacco, Cigars and Cigarettes	2,331	2,836	5,167	1,992	385	3,869	15,105	18,974
Food, Drink and Tobacco totals (u)	92,313	31,733	124,046	52,229	421	103,076	285,440	388,516

Explanatory Footnotes to Both Tables

- (a) These employment figures are taken from monthly payroll-tax returns and differ slightly from the other employment figures, which are supplied on annual factory returns.
- (b) Also includes wheatmeal; macaroni, spaghetti, vermicelli; and mustard.
- (c) Not collected.
- (d) Included with sub-class "Other"—see footnote (t) below.
- (e) Separate figures for each sub-class were not published.
- (f) Also includes dog biscuits, stock licks and salt licks. In 1938-39 the sub-class was entitled "Cattle and Poultry Foods (not Oilcake)".
- (g) Also includes soups, and fruit and vegetable dehydration, where carried on as associated but lesser activities to jam, fruit and vegetable canning. Also includes fruit peel.
- (h) Establishments in Tasmania classifiable within the sub-class "Pickles, Sauces, Vinegar" were included in the sub-class "Jam, Fruit and Vegetable Canning".
- (j) Also includes potato chips, crisps, flakes, etc. Does not include sun-dried tree and vine fruits, the production of which is not a manufacturing industry. At 1938-39 the sub-class was entitled "Dried Fruits".
- (k) Also includes tea blending and packing; self-raising flour, baking powder, jelly crystals, custard powder, pepper, curry, ginger and other grocers' sundries; and flavouring essences.
- (l) Also includes soups where made as the sole or major activity.
- (m) Also includes meat pastes, fish pastes, meat dehydration. Does not include slaughtering and abattoir activity, which is not a manufacturing activity for factory statistics purposes.
- (n) Also includes bone milling; and meat meal, animal manures.
- (o) At 1938-39 the sub-class was entitled "Butterine and Margarine".

- (p) The published official statistics for 1938-39 and 1949-50 explain that establishments are classifiable as "Condensed, Dried and Processed Milk" factories in Victoria, South Australia and Tasmania, and establishments classifiable as "Cheese" factories in Victoria and Tasmania are included in the sub-class "Butter" (at 1938-39 entitled "Butter Factories, Creameries, etc."). This practice probably extends to the published statistics from which the June 1950 and September 1951 figures are taken. Because of this and because of extensive inter-activity of factories engaged in manufacture of milk products (which includes butterfat products) other than ice cream, the three sub-classes in the Comparative Statistics table above are totalled into one set of statistics for milk-products factories, excluding ice cream. The 1949-50 statistics in the Statistical Summary table above were published in totalled and unseparated form in the statistics source used.
- (q) Establishments in Tasmania classifiable within the sub-class "Confectionery (including Chocolate and Icing Sugar)" were included in the sub-class "Bakeries (including Cakes and Pastry)".
- (r) At 1938-39 the sub-class was entitled "Sugar Confectionery (including Chocolates)".
- (s) The sub-class "Other" is one of miscellaneous activities not elsewhere included within the Commonwealth Statistician's Class IX, "Food, Drink and Tobacco". The sub-class includes egg processing; fruit packing and grading; fruit refining; gelatine manufacture; meat boning, rabbit boning and packing; seed cleaning, grading and packing; manufacture of vegetable extracts.
- (t) These figures include those for sub-classes additional to the sub-class "Other" because separate figures were not separately shown in the published statistics available. The 1949-50 figures, both tables, include those for the sub-classes "Sugar Milling" and "Sugar Refining". The figures for June 1950 and September 1951 include employees for the sub-classes "Arrowroot" and "Animal and Bird Foods".
- (u) Consideration and comparison of totals must take into account the effects stated in footnotes explaining the composition of certain sub-classes and figure units.
- (v) Also includes fruit syrups and fruit juices where made as the sole or major activity; and non-intoxicating brewed beer.
- (w) Also includes distilleries making power alcohol and/or methylating spirit made in the same distillery.
- (x) These two sub-classes should be read as one. Establishments in South Australia engaged in distilling of spirit have been included, in published official statistics, in the sub-class "Winemaking" from and including the year 1941-42. The published statistics for 1940-41 show that of the 40 distilleries classifiable as being wholly or mainly in the activity, 26 were in South Australia. At 1952, 31 premises in South Australia were licensed by Excise Branch to distil—9 as general distillers, 21 as wine distillers, 1 as a vigneron distiller (see "Wine, etc.". Part One of this chapter for explanation of types of licences). Whisky and gin is made in South Australia. In Victoria four distilleries concerned with distilling from wine or lees of wine for own use and for sale are statistically classified as within the distillery sub-class, and all vigneron distillers (licensed to make spirit only for own use) are statistically classified in the winemaking sub-class.
- (y) Includes wines fortified with grape spirit, and includes distilling of wine where carried on as the lesser activity within winemaking generally.
- (z) Includes bottling of non-beverage liquids.

Chapter 14:

**LEATHERS, WOOLLED SKINS, and
PRODUCTS**

Part One: Structure of Established Manufacturing Activities

THE activities of fellmongering, tanning (and tawing) of hides, skins, woolled skins and pelts (but not fur pelts), currying and dressing of leathers, and manufacture of products made mainly either of leathers or woolled skins, are established in Australia as listed below, the extent of association of activities being shown by bracketing and annotation. The listing is intended to be reasonably indicative, but not necessarily inclusive.

FELLMONGERY

There are 43 fellmongeries engaged in the removal of wool from sheepskins (using either the sweating or painting process) and the recovery of wool from sheepskin pieces. In most cases pelts are taken to the pickled pelt stage. (Official statistics of the employment size and other aspects of establishments engaged mainly or wholly in fellmongery cannot be provided as the activity is grouped for statistical purposes with scouring and/or carbonising—see Scouring and Carbonising, Chapter 15, "Textiles, Felting, Cordage".) The greater part of output is by fellmongeries supplied with green skins from meatworks and abattoirs (mainly the former); most fellmongers will treat dried skins if necessary to maintain output when green skins are scarce. Practically all the fellmongeries scour the skin wool produced by them. In addition about 20 (mainly the larger establishments) engage in wool scouring on their own behalf or on a commission basis. The largest of these fellmongeries are either part of a meatworks or associated companies of meatworks. The independent specialist fellmongeries are usually medium to small in size. Two of the 20 are associated with topmaking and tanning activities, two are parts of topmaking companies, and one is associated with stock killing, meat packing, worsted-yarn manufacture.

TANNING (including Tawing), CURRYING, DRESSING

Heavy to medium-weight leathers, including sole, kip, belting and lace, saddlery and harness, strap, bag, case, sporting and associated treatment of splits.

Upholstery and similar leathers and associated treatment of splits.

Leathers for shoe and boot uppers, handbags, gloves, garments, fancy and fashion leathers generally (including reptile and marsupial) and associated treatment of splits. Sheep and lamb pelt tanning and dressing—basils, and roans (occasionally) skivers, usually shaved; and chamois, shaved.

Tanning of woolled sheep and lamb skins, currying and dressing, unassociated with tanning or other products manufacture.

Currying and dressing, unassociated with tanning or product manufacture, is limited to a few establishments—mainly small.

In 1949-50 there were 145 establishments and in 1948-49 144 establishments wholly or mainly engaged in tanning and/or preparation of leathers. Of the 1948-49 establishments, 49 each employed up to 10 persons, 30 each from 11 to 20 persons, 39 each from 21 to 50 persons, 15 each from 51 to 100 persons, and 11 each more than 100 persons; the latter 11 establishments employed 2,344 persons out of the industry total of 5,435 persons; the more-than-50 group employed 3,395 persons, and the less-than-50 group 2,040 persons. The division of activities shown at the left is very broadly indicative of separations brought about by tanning (and tawing) methods (including vegetable, chrome, combination, oil, formaldehyde, alum), by availability of hides, skins and pelts, and by the end use of products. Many tanneries confine their activity to the treatment of a few leathers of a like type (one of which may be the main leather produced).

The range of products made by the individual members of the industry varies considerably. A few tanneries make a wide range of leathers, while about 23 tanneries specialise in sole-leather production. A few specialise in the tanning of woolled sheep and lamb skins used in the manufacture of slippers, "snowboots", garments, trimmings, polishing pads and buffs, rugs and toys. They also produce furriers' coating when an effective demand exists. The making up of these various products is not usually undertaken by the tanners. Several small tanneries are also fur dressers. Currying and dressing of leathers, embossing, printing, dyeing, and similar finishing operations are mostly done at tanneries. All tanneries producing splits do not treat the splits themselves. Some tanneries or their subsidiary or associate companies are engaged in the manufacture of one or more types of leather products, including belting, cut stock for footwear manufacturers, sporting goods, travel goods, combined canvas and leather goods, etc. Specialist activity in the industry is increasing. Several tannery companies are among the major grindery warehouses of Australia. Some tanneries cut soles, welting, sanding and similar boot trade requirements.

(Fur dressing in Australia is more an adjunct of the clothing industry than of the tanning industry—see Chapter 16, "Clothing, Manchester, Napery, Footwear".)

MANUFACTURING OF PRODUCTS OF LEATHER AND WOOLLED SKINS

BELTING AND INDUSTRIAL LEATHER PRODUCTS

Transmission and conveyor belting of leather or rubber composition.

Mechanical leather products, including pump buckets, hydraulic and pneumatic packings, oil-seals (including spring-seal type), washers; and textile leathers.

In 1949-50 there were 17 establishments wholly or mainly engaged in manufacture of belting and/or industrial leather products. In 1948-49, 11 each employed up to 10 persons, 2 each from 11 to 20 persons, 2 each from 21 to 50 persons, and 2 each from 51 to 100 persons; the last 2 establishments employed 179 persons out of a total of 317 persons. In addition, there were three rubber-products companies

making rubber/canvas belting as a lesser part of general rubber-products manufacturing (see Chapter 8, "Rubber Products"). Eight of the establishments classified as specialist manufacturers of belting each have their own tannery, and six also make other types of leathers such as sole, harness, hydraulic, etc. The greater part of production of leather belting and most of the industrial leather products other than belting in Australia come from these eight establishments. Only one manufacturer makes both leather belting and rubber/canvas belting, the latter, in flat, vee and conveyor, being the principal product. Except for some chrome tanning, manufacture of leather belting, mechanical leather products and textile leathers, begins at currying. The smaller specialist manufacturers of leather belting and/or industrial leather products in Australia usually use prepared leathers obtained elsewhere. Some of the belting manufacturers distribute their own products, being also engaged as wholesalers. One of the largest manufacturers, in addition to operating a tannery and distributing products of its own manufacture, also makes mechanical leather products, textile leathers, industrial gloves of leather, and of leather and canvas, protective clothing of leather, and a large range of transmission equipment, including pulleys, bearings, hangers, gears, drives, clutches, and also sells transmission equipment made by other makers.

SADDLERY AND HARNESS: In 1949-50 there were 73 and in 1948-49, 71 establishments wholly or mainly engaged in saddlery and harness making and/or repairs. Of the 1948-49 establishments, 50 each employed up to 10 persons, 11 each from 11 to 20 persons, 9 each from 21 to 50 persons, and 1 a few more than 50 persons; the 10 establishments each employing more than 20 persons employed 316 persons out of a total of 696 persons. Most of the small establishments are in country towns. The larger manufacturers are in metropolitan areas and often make, as a lesser activity, other types of leather goods as well as saddlery and harness.

TRUNKS, CASES, BAGS, SMALL LEATHER GOODS

Trunks, cases and bags, made from compressed fibreboard, leatherboard, and fabric covering on uncoated backing (plywood backing in high-quality goods and leather). Metal trunks and cases. Sliver cans of vulcanised fibreboard, metal-reinforced, for the textile industry.

Ladies' handbags (of leather, plastics and fabric coverings); travel bags, satchels, briefcases, dress accessories, purses, wallets, dress gloves.

Miscellaneous small leather goods, including purses, wallets, wristwatch straps, strops, belts, braces, plaited goods, dress accessories, novelty items, small cases for brush sets, instruments, etc.

Woolled-skin products.

In 1949-50 there were 303 and in 1948-49 281 establishments wholly or mainly engaged in one or more items of trunks, cases, bags, handbags, miscellaneous small leather and woolled-skin goods. Of the 1948-49 establishments, 152 each employed up to 10 persons, 64 each from 11 to 20 persons, 53 each from 21 to 50 persons, 7 each from 51 to 100 persons, and 5 each more than 100 persons. The more-than-50 group employed 1,332 persons out of the activity total of 4,824 persons; the 21-50 group, 1,682 persons; and the not-more-than-20 group 1,810 persons. The larger establishments are those primarily concerned with travel goods. Some travel goods manufacturers, and some handbag manufacturers, are also retailers of their own and others' products. There are specialists within the activities separated at

the left. However, overlapping between the activities for which plant and methods are readily adaptable is commonplace. Most of Australia's output of compressed fibreboard, leatherboard, fabric covering on uncoated backing, and leather trunks, cases and bags is produced by several large specialist manufacturers. Two or three of them also produce metal trunks and cases. (These are also made by some sheetmetal-working establishments.) Sliver cans are also made by two manufacturers. There are also small establishments specialising in case and bag manufacture, and in addition other establishments, mainly ladies' handbag manufacturers produce cases and bags in conjunction with other products of similar material or construction. Much of the ladies' handbag production is by several specialist manufacturers. Others make travel bags, satchels, brief cases, dress accessories, purses, wallets and dress gloves in addition. Much of the output of miscellaneous small leather goods is from the larger manufacturers of leather goods although there are also a number of small enterprises also engaged. Over 85 per cent. of the woollen-skin products are used for slipper manufacture (see Chapter 16, "Clothing, Manchester, Napery, Footwear"). A few small specialist manufacturers make up polishing pads (for cars, shoes, etc.), industrial polishing buffs, toys, dusters, novelties, etc.

SPORTING GOODS AND GARMENTS OF LEATHER

Sporting goods of leather, and of leather and canvas combined.

Dress gloves of leather; motoring gloves.

One or more of these products are made as an incidental or lesser activity, regularly or intermittently, in the establishments classified as wholly or mainly leatherworking. Specialist establishments are not classified in official statistics as leatherworking establishments, but are placed

Industrial gloves of leather: of leather and canvas combined; and of canvas.
Coats, jackets, breeches, etc., of hide, and woolled sheepskin garments.

according to product—gloves, coats, jackets, etc. (see Chapter 16, "Clothing, Manchester, Napery, Footwear"). Sporting goods are placed with manufacture of toys, games and sports requisites (see Chapter 12, "Machinery, Plant, Equipment, Apparatus, Not Elsewhere Included").

(Manufacture of leather footwear and leather components for footwear is an industry activity dealt with in this study in Chapter 16, "Clothing, Manchester, Napery, Footwear".)

Part Two: Outline of Capacity of Manufacturing Activities

AUSTRALIA is a large producer of hides and skins. The greater quantity of its bovine hides and skins, and de-woolled sheep and lamb pelts, are tanned in Australia; the remainder, is exported in raw condition (dried, salted, pickled). The greater quantity of sheep and lamb woolled skins, horse hides, rabbit skins and marsupial skins are exported in raw condition, mainly air dried.

The quantity and value of hides and skins exported in 1948-49 and 1949-50 were as follows

(see later for comment on control of export of bovine hides and skins)—

EXPORTS—HIDES and SKINS:		1948-49		1949-50	
Cattle hides	no.	270,000	£1,175,000	257,000	£1,336,000
Yearling skins	no.	—	—	2,000	£1,000
Calf skins	no.	22,000	£9,000	16,000	£18,000
Horse hides	no.	43,000	£123,000	48,000	£135,000
Sheep and Lamb skins—					
With wool	no.	11,255,000	£7,339,000	14,919,000	£10,877,000
Without wool	no.	814,000	£108,000	3,441,000	£826,000
Pieces	lb.	196,000	£12,000	460,000	£34,000
Rabbit and hare skins	lb.	9,812,000	£3,004,000	10,541,000	£640,000
Fox skins	no.	29,000	£5,000	51,000	£7,000
Kangaroo and wallaby skins	lb.	1,160,000	£413,000	723,000	£193,000
Other marsupial skins, and furred skins, n.e.i.	no.	26,000	£7,000	242,000	£48,000
Other hides and skins, n.e.i.	no.	18,000	£9,000	29,000	£33,000
Totals		—	£12,205,000	—	£15,149,000

Australia imports hides and skins—bovine hides and skins, sheep skins and pelts, from New Zealand and Pacific Island groups adjacent to Australia; and from elsewhere, skins

(particularly goat) not available in quantity or at all in the Australasian region. The quantity and value of hides and skins imported in 1948-49 and 1949-50 were as follows—

IMPORTS—HIDES and SKINS:		1948-49		1949-50	
Cattle hides	no.	33,000	£53,000	33,000	£56,000
Yearling skins	no.	9,000	£20,000	9,000	£19,000
Calf skins	no.	9,000	£9,000	1,000	£1,000
Sheep and Lamb skins—					
With wool	no.	84,000	£52,000	57,000	£17,000
Without wool	no.	16,000	£6,000	259	£182
Pieces	lb.	—	£1,000	—	£1,000
Goat skins	lb.	1,460,000	£508,000	917,000	£361,000
Rabbit skins	lb.	18,000	£12,000	38,000	£12,000
Furred skins, n.e.i.	no.	521,000	£301,000	444,000	£363,000
Reptile skins	lb.	10,000	£13,000	9,000	£16,000
Other skins, n.e.i.	lb.	221,000	£21,000	165,000	£41,000
Totals		—	£994,000	—	£887,182

Australia imports a substantial quantity of bark and bark extract (mainly from South Africa and India, despite indigenous resources of tanning barks and the processing of these barks in Australia (see Chapter 3, "Timber

and Bark Preparation, and Products Mainly of Wood, etc."), and export of extract (mainly to Europe). Exports and imports for 1948-49 and 1949-50 were as follows—

EXPORTS:		1948-49		1949-50	
Bark	cwt.	22	£119	—	—
Extract		98,322	280,383	85,468	233,692
Other tanning substances		844	2,375	2,132	6,248
Totals		99,188	£282,877	87,600	£249,940
IMPORTS:		1948-49		1949-50	
Wattle bark	cwt.	27,444	£36,192	21,464	£25,316
Other bark		246	617	—	—
Wattle bark extract		111,972	263,073	119,291	283,571
Quebracho extract		198	850	—	—
Extracts, other		5,705	8,491	3,347	4,915
Other tanning substances (including valonia, myrabolans, cutch, etc.)		49,603	56,480	33,548	40,842
Totals		195,168	£365,703	177,650	£354,644

About five-sixths of Australian leather production (sole, upper-leathers, rough-tanned and dressed splits, and sheep leather) is utilised in Australia. Imports of leathers are not considerable—kid, calf, hog and reptile being among the larger items. (See later for statistics of exports and imports of leathers.)

Imports of leather products are quite small. A small export trade has been developed.

An outline of capacity of fellmongery, tanning and leather products industries in Australia is given below.

FELLMONGERY

The Australian fellmongering industry has been operating for about a century. The forty-three fellmongers operating in 1951 may be divided into a few broad groups. These comprise: (1) the very small firms which specialise in the treatment of sheepskin pieces and which in most cases do not possess scouring machines; (2) the small to medium-sized firms which are not directly associated with killing establishments and which purchase sheepskins in competition with overseas buyers; (3) the large firms which are either associated with or are part of killing establishments; and (4) large firms which use some or all of the wool produced in worsted top-making and spinning.

The production of sheepskins in Australia is much greater than the number fellmongered here. There is a strong overseas demand for sheepskins, mainly from France and to a lesser extent from the United Kingdom. The following table compares the numbers of sheepskins fellmongered in Australia and the numbers of woolled sheepskins exported, for the years 1938-39 and 1947-48 to 1949-50—

COMPARISON:	Skins Woolled Skins	
	Fellmongered	Exported
	millions	
1938-39	6.98	12.63
1947-48	5.98	10.86
1948-49	6.02	10.75
1949-50	8.39	14.18

The rate of fellmongering in Australia is directly related to the profitability of treating the skins here. Overseas countries with lower processing costs are generally able to obtain a large proportion of the skins which come on to the Australian market. At times even slaughter establishments with fellmongering

facilities find it more profitable to dry the green skins for export than to fellmonger them. At present the Australian industry is processing about 7 million skins a year. During the wartime years 1941-1945 when it was not possible to export sheepskins to any extent, the fellmongers, with the aid of additional labour, increased their intake considerably. In 1943-4, the peak year, over 14 million skins were fellmongered. During this period, capacity which is normally only fully used at the height of the sheep and lamb slaughter season was used to a much greater extent. With the return of export of sheepskins in 1946, the rate of fellmongering reverted to its pre-war level of about 6 to 7 million skins a year. The capacity of industry working full time for the whole year is about 24 million skins a year.

The industry uses both the painting and sweating processes, the painting process being preferred where a large number of skins has to be treated quickly. Fellmongering is usually classified as a noxious trade in Australia and consequently in built-up areas can only be undertaken in areas set aside for these trades. The pieing of sheepskin pieces (mainly using a bacterial skin-digestion process) is widely practised and accounts for about 10 per cent. of the skin wool produced.

There is ample capacity available in Australia for the treatment of additional quantities of sheepskins should economic conditions render it profitable to do so. Some difficulty might be experienced, however, in obtaining adequate supplies of additional labour, as in many establishments conditions are wet and relatively unattractive.

TANNING (including Tawing), CURRYING, DRESSING

The industry is heavily concentrated in the large population areas of south-eastern Australia, about 80 per cent. of the numbers of factories and employees being either in Victoria or New South Wales. There are no significant gaps in the quantity, range and quality of products. Some few specialties are not made; for example, the leather required for cotton-spinning rollers—the breed of sheep from which a suitable pelt is secured is not established in Australia. Where output is at present less than demand the reasons advanced are usually those of insufficient supply of hides, skins, pelts, and labour shortages. Calf and yearling skins for shoe-upper leathers are scarce because present high world prices for beef and favourable seasons have encouraged growers to sell less young stock.

The distribution of bovine hides and skins is strictly controlled by the Australian Hide and Leather Industries Board, a Commonwealth instrumentality empowered by statute to control the sale and export of hides and leather; the Commonwealth Statute is complementary to identical Statutes of each Australian State. Hides, when appraisalment and allocation occur, become the property of the Board. The rates of payment to the producer are determined as provided in the Commonwealth Statute. The Board determines what hides may be sold for home consumption and what for export; sales being by auction as

prescribed in the Statutes. The Board also issues licences to dealers in hides and exporters of leather to carry on those activities to the extent specified in the licence. The hide and leather controls ensure that Australian requirements are reasonably met at prices considerably below world parity.

The ready availability of sheepskins and pelts has led to the development of specialist tanneries or dressers producing one or more products such as basils, roans, chamois, linings and similar light leathers, and of tanned woolled sheepskins. (In Australia, a basil is a rough vegetable-tanned skin; a roan is a finished vegetable-tanned skin; chamois is a shaved sheep-pelt.) At present the high export prices for woolled skins and pelts (which are free of domestic price and distribution control) have made tanners and dressers reluctant to operate freely, and output of sheep leathers and dressed skins is consequently falling. Capacity is adequate to meet internal demands and output could be immediately increased should sheepskin prices fall to attractive levels. The demand for furriers' coatings made from sheepskins is quite small in Australia, and export is negligible.

The Australian tanning industry in 1949-50 used materials valued at £6.8 million; the value of its output was £11.4 million. The following table shows details of materials used and articles produced in 1949-50—

canvas belting, the manufacture of which is less hindered by raw material shortages; increased industrialisation in Australia has greatly increased the demand for heavy leathers. Only one manufacturer of leather belting also makes rubber-canvas belting. (See Chapter 8, "Rubber Products", for comment on rubber-canvas belting manufacture.)

SADDLERY AND HARNESS

An increasing degree of mechanisation of agricultural and pastoral activities has speeded over recent years the drop in demand for saddlery and harness that began years ago with widespread use of motor transport. (Live-stock statistics show only 1.0 million horses (excluding those living in the wild state) in Australia at March, 1951; average for five years ended 1939 was 1.75 million.)

The scarcity of tradesmen skilled in saddle and harness making, combined with occasional shortages of certain leathers, has resulted in the demand, particularly for saddles, not being fully met in some localities. Manufacturing capacity, however, is considered to be ample to meet the overall demand.

Imports of saddlery and harness in 1948-49 and 1949-50 were valued at £3,800 and £8,993; exports for the two years were valued at

LEATHERGOODS

Established capacity in Australia for manufacture of leathergoods (excluding footwear—see Chapter 16) is adequate to meet the local demand for these goods and could readily expand to cope with increased consumption.

TRUNKS, CASES AND BAGS

Australian production of trunks, cases and bags in 1949-50 was as follows—

PRODUCTION:	1949-50	
	no.	£
Trunks of all kinds	4,690	34,814
Trunks and boxes, metal	—	71,367
Suitcases—leather	64,737	196,776
fibre	618,945	742,543
Kitbags, leather	108,966	173,009
Schoolbags	107,222	44,492
All other bags, excluding purses—		
Canvas	21,506	36,576
Leather	293,094	477,413
Plastic	85,051	36,597
Fibre	119,318	85,798
Other	92,780	39,296
Totals	1,516,309	£1,938,681

Exports of trunks, cases and bags (including handbags, purses, wallets, boxes) of leather in 1949-50 were valued at £3,938; while those of materials other than leather were valued at £27,816. Exports were made mainly to Australian Territories, Pacific Islands, New Zealand and South Africa.

Imports of trunks, cases and bags, satchels, and sporting bags of leather in 1949-50 were valued at £32,459, while those of other materials were valued at £61,276.

The range of goods made includes portmanteaux, air-travel cases and modern-style "wardrobe packs". Fibreboard and fabrics are the

LADIES' HANDBAGS

Australian production of handbags in 1949-50 was as follows—

PRODUCTION:	1949-50	
	no.	£
Handbags—Leather	1,060,057	1,677,938
Plastic	502,666	483,769
Other	88,462	104,837
Totals	1,651,185	£2,266,544

The leather-belting manufacturers are the principal source of industrial leather products in Australia, and, with the smaller specialist manufacturers could readily extend capacity to meet expansion of demand. The supply of leather products has also been affected by shortages of material and labour.

£19,500 and £14,050. Production of principal items in 1949-50 included 6,024 collars, valued at £15,221, 10,576 saddles, valued at £119,308, parts valued at £96,143, and single sets of harness valued at £102,029; production figures for double sets of harness are not available.

Pastoral and agricultural requirements make up much of the demand, which is greatest in New South Wales and Queensland country areas. Horse-drawn vehicles are used in considerable numbers in built-up areas for home delivery of foodstuffs (mainly milk and bread), but only to a small extent for transport of other goods. Demand for saddlery and harness required for equestrian sports has been steady and tending to increase, but is not great.

Hardware for saddlery and harness, except for some minor items, is mostly imported.

A very wide range of items is made, in both standard and fashion styles. Imports have not been considerable, and modest exports have been made.

principal outer coverings used, but leather is used to a substantial extent for better-grade lines and almost exclusively for certain types of standard lines such as kitbags, attache cases, schoolbags, satchels and brief cases. Sliver cans (mill cans, spinning cans), are manufactured in Australia for the textile industry; materials used are compressed fibreboard and metal reinforcement.

Fibreboard and leatherboard requirements are almost entirely imported. Fabric for outer coverings and linings are also mainly imported. Uncoated backing is made in Australia; also a small amount of compressed fibreboard (laminated). Hardware for trunks, cases and bags—locks, handles, hinges, plates, corners, etc.—is made in Australia, principally by one manufacturer who also makes builders' and cabinet hardware; however, imported hardware is commonly used—particularly locks. Kitbag and case frames are made in Australia, and also imported. (In 1949-50, 18,500 kitbag frames valued at £5,000 were imported, and also 691,000 case, bag and handbag frames, valued at £105,000.) Slide fasteners are made in Australia by several manufacturers, and are also imported in substantial quantities. The value of fittings and internal furnishings used in the manufacture of bags and trunks in 1949-50 was £556,356. (See also Chapter 12.)

Export of ladies' handbags is believed to be quite small (export statistics for handbags are not separately recorded). Imports in 1949-50 of ladies' handbags of leather were valued at £32,200; of fabric, £12,400; of other materials, £58,400—totalling £103,000. Handbag frames and fittings are made in Australia, but imports are understood to be substantial (details are not recorded separately).

MISCELLANEOUS SMALL LEATHERGOODS

A great variety of small articles of leather and, to lesser extent, of tanned woolled sheepskins, are made in Australia. They are mainly utility products, but include some high-grade personal articles. The value of output of such goods is not separately recorded; it is esti-

mated to have been not less than £1,200,000 in 1949-50.

Imports of wallets (mainly for men) and purses in 1949-50 were valued at £19,300; imports of other small leather goods are valued at about £50,000 a year. Exports are small.

GLOVES, GARMENTS AND SPORTING GOODS OF LEATHER (OR MAINLY OF LEATHER)

In this study the manufacture of gloves and garments, whatever the material used (other than asbestos), is considered, for convenience, as part of the clothing industry. In fact, however, specialist establishments engaged in the making of leather coats, jackets, breeches, etc., or of industrial gloves of leather, leather/canvas, and canvas, are usually closer to the leathergoods industry than to the clothing industry; such products

are also made within the leathergoods industry proper. A similar position exists with sporting goods of leather and leather/canvas. For comment on manufacturing capacity, demand, etc., see Chapter 16, "Clothing, Manchester, Napery, Footwear", for gloves and garments; and Equipment section of Chapter 12, "Machinery, Plant, Equipment, Apparatus, Not Elsewhere Included" for sporting goods.

Part Three: Basic Statistics

COMPARATIVE STATISTICS, 1938-39/1949-50

NUMBER OF ESTABLISHMENTS AT 1938-39 AND 1949-50

NUMBER OF EMPLOYEES AT 1938-39, 1949-50, JUNE 1950, SEPTEMBER 1951

Activity (Statistical Sub-classes used by Commonwealth Statistician, 1949-50)	Establishments		Employees			
	1938-39	1949-50	1938-39	1949-50	June 1950 (a)	Sept. 1951 (a)
Woolscouring and Fellmongery (b)	no. (c) 70	no. 84	no. (c) 1,582	no. 4,009	no. 4,144	no. 3,227
Tanning, Currying and Leather Dressing (d)	132	145	4,375	5,473	5,554	5,151
Saddlery, Harness and Whips	59	73	518	689	643	572
Machine Belting (Leather or Other) (e)	14	17	152	332	(g) 4,745	(g) 4,285
Bags, Trunks and Other Goods of Leather and Leather substitutes (f)	117	303	2,680	4,848		
Other (of Class VII) (h)	3	(h)	74	(h)	(h)	(h)
Totals (j)	395	622	9,381	15,351	15,086	13,235

STATISTICAL SUMMARY, 1949-50

EMPLOYMENT, MALE AND FEMALE

SALARIES AND WAGES PAID, IN TOTAL AND PER PERSON ENGAGED

VALUE OF PRODUCTION

VALUE OF MATERIALS, POWER, FUEL, REPAIRS, etc. }

See Explanations,
Appendix IV

VALUE OF OUTPUT

Activity (Statistical Sub-classes used by Commonwealth Statistician, 1949-50)	Employment			Salaries and Wages Paid		Value of Pro- duction	Value of Materials, Fuel, etc. Used	Value of Output
	Males	Females	Persons	Total	Per Person Engaged			
Woolscouring and Fellmongery (b)	no. 3,872	no. 137	no. 4,009	£'000 2,201	£ 549	£'000 4,284	£'000 19,280	£'000 23,564
Tanning, Currying and Leather Dress- ing (d)	5,147	326	5,473	2,755	503	4,330	7,089	11,419
Saddlery, Harness and Whips	539	150	689	225	336	365	343	709
Machine Belting (Leather or Other) (e)	267	65	332	151	455	283	331	614
Bags, Trunks and Other Goods of Leather and Leather Substitutes (f)	2,145	2,703	4,848	1,020	334	2,866	3,002	5,868
Other (of Class VII) (h)	(h)	(h)	(h)	(h)	(h)	(h)	(h)	(h)
Totals (j)	11,970	3,381	15,351	6,952	453	12,129	30,045	42,174

Explanatory Footnotes to Both Tables

- (a) These employment figures are taken from monthly payroll-tax returns and differ slightly from the other employment figures, which are supplied on annual factory returns.
- (b) Also includes carbonising. Fellmongeries usually scour the skin-wool resulting from wool-removing operations, but are frequently also engaged in scouring of greasy wool.
- (c) At 1938-39 the sub-class was entitled "Fellmongery", but the official published statistics explain that the establishments in New South Wales, Queensland and Western Australia classifiable as woolscouring establishments were included in the sub-class. Establishments in South Australia classifiable as a fellmongery, and establishments in Victoria, South Australia and Tasmania as woolscouring establishments, were included in the sub-class then entitled "Wool, Worsted and Shoddy (including Woolscouring)". See also footnote (c), Part Three, Chapter 15, "Textiles, Felting, Cordage".
- (d) Also includes the tanning sections of establishments principally engaged in manufacture of belting; and dressing of woolled skins of sheep and lamb. Does not include fur dressing.
- (e) Does not include belting made of materials other than leather where the manufacture of such belting is carried on as an incidental part of activity in establishments in other industries, for example, rubber belting and woven belting of cotton.
- (f) Includes bags, handbags, cases, trunks, etc., wholly or partly of materials other than leather, but does not include the activity of making sheetmetal trunks, cases, etc., where such is a minor part of general activity in a sheetmetal-working establishment. Also includes leather toys and ornaments of leather; art leather activities, including burnt leather; leather shoe and boot laces; leather goods of varied nature, not elsewhere covered; leather clothing, gloves, sporting goods, but only where made as a lesser activity in association with other leather goods. (Where carried on as the major activity, leather clothing is included in the sub-class "Tailoring and Ready-made Clothing" of the Commonwealth Statistician's Class VIII, "Clothing (except Knitted)"; industrial and dress gloves of leather are included in the sub-class "Gloves" of Class VIII; and sporting goods of leather are included in the sub-class "Toys, Games and Sports Requisites" of Class XV, "Miscellaneous Products".)

- (g) Separate figures were not published for each sub-class.
- (h) Should be read as being inclusive with the sub-class "Bags, Trunks and Other Goods of Leather and Leather Substitutes". The sub-class "Other" (of Class VII) is now, in effect, an inoperative sub-class.
- (j) Consideration and comparison of totals must take into account the effects stated in footnotes explaining the composition of certain sub-classes and figure units.

Chapter 15:

TEXTILES

FELTING

CORDAGE

Part One: Structure of Established Manufacturing Activities

PREPARATION of fibres and manufacturing of yarns and threads, woven fabric, woven and braided narrow fabrics, crocheted fabrics, carpeting and carpets, industrial, flooring and apparel felts, and cordage, are established in Australia as listed below, the extent of association of activities being shown by bracketing and annotation. The listing is intended to be reasonably indicative, but not necessarily fully inclusive. (For knitted fabrics and garments, see Chapter 16, "Clothing, Manchester, Napery, Footwear".)

WOOL TEXTILES—Preparation, Carding, Combing, Spinning, Doubling, Winding, Weaving, Dyeing, Finishing

INTEGRATION: The major part of Australian output of finished wool textiles is produced by partly or wholly integrated manufacturers treating wool from the greasy state through all, or practically all, processes to the finished piecegoods. About two-thirds of the total spindles and looms engaged in production of worsted and woollen fabrics in Australia are contained in about 30 large integrated mills. (See also a description, pages 402-406, at the end of this Part, of Felt & Textiles of Australia Ltd. and associated companies, the largest textile group in Australia, which processes wool from the greasy state onwards, including felt making and carpet weaving, and is also engaged in hair processing, textile-waste processing, clothing and footwear manufacture.) Specialisation (that is, limitation to one process only) is not insignificant, particularly in worsted spinning and in weaving of wool piecegoods. Most of the scouring and carbonising of greasy wool, also, is done by companies or businesses mainly engaged only in one or both of these processes, and sometimes also in fellmongering. The manufacture of carpets and carpeting and of felt is also largely unassociated directly with other wool manufacturing. There are more than 200 establishments engaged in one or more of the processes of scouring, carbonising, topmaking, wool spinning, doubling, winding, and weaving (including associated dyeing and finishing, and the spinning sections of carpet mills and of knitting mills). The following table presents the activities of 165 companies or businesses currently engaged in the processes, from scouring to finishing, given at the head of the table. Forty-six of these companies are engaged in scouring and/or carbonising only, the remaining 119 companies, some of which are associated, operate 143 establishments. (This table does not include manufacturers engaged only in doubling, winding, dyeing, printing or finishing, or knitting companies which also spin.)

COMPANIES OR BUSINESSES		DETAIL OF INTEGRATION									
General Description of Overall Activity	Number Engaged Within Each Combination of Activities	Scouring (a)	Carbon- ising (a)	Top- making	Worsted Spinning (b)	Worsted Weaving	Woollen Spinning	Woollen Weaving	Dyeing	Finish- ing	Weaving only
Scourers and/or Carbonisers	36 (c) . . 3 7	x	x								
Topmakers	3 (d) . . . 4 (e) . . .	x	x	x							
Worsted Spinners	2 (f) . . . 9	x		x	x						
Worsted Spinners and Weavers	5 5				x	x			x	x	
Integrated Worsted Mills	4	x		x	x	x			x	x	
Woollen Spinners	5						x				
Woollen Spinners and Weavers	2 11						x	x	x	x	
Integrated Woollen Mills	4 4 1	x	x				x	x	x	x	

(Table is continued on next page)

Integrated Worsted and Woollen Mills except for Topmaking	3 5 1 1	X X 	X X 		X X X X	X X X X	X X X X	X X X X	X X X X	X X X X	
Fully Integrated Worsted and Woollen Mills	4 1 1	X X 	X 	X X X	X X X	X X X	X X X	X X X	X X X	X X X	
Weavers of Worsted or Woollens or Both	44										X

- (a) The manufacturers included in this table produce about 85 per cent of the scoured and treated wool; the balance is produced by fellmongering establishments (see also "Fellmongery", Chapter 14).
 (b) Worsted spinning is also carried on by 8 knitters not included in this table; one of these also scours and combs.
 (c) Fourteen of these also fellmonger.
 (d) Two of these also fellmonger.
 (e) One of these also fellmongers.
 (f) One of these firms also fellmongers.

PRINCIPAL MACHINE EQUIPMENT: The following table provides an outline of principal machine equipment in wool-textile mills (excluding knitting) in Australia and shows expansion over recent years compared with 1938-39—

	Carding	Gilling	Combing	Drawing	Spindles	Looms
	no.	no.	no.	no.	no.	no.
1938-39	464	558	347	463	333,242	4,348
1945-46	446	507	282	525	408,097	4,926
1946-47	456	520	293	575	386,396	5,031
1947-48	465	546	296	597	445,476	5,217
1948-49	507	(a)	352	(a)	430,162	5,779
1949-50	506	(a)	401	(a)	442,324	5,935

(a) Details not collected.

The numbers of cards, combs, spindles and looms installed in Australian wool-textile mills as at 30th June, 1951, increased to 541 cards, 374 combs, 463,000 spindles and 6,357 looms.

EMPLOYMENT SIZE OF MILLS: In 1949-50 there were 168 establishments, and in 1948-49 153 establishments, wholly or mainly engaged in one or more of the processes of topmaking, wool spinning, doubling/winding, weaving, including associated scouring, carbonising, dyeing, fabric finishing, spinning sections of knitting mills and carpeting mills, but not including scouring and/or carbonising works not integrated within a textile mill, felt mills, carpet-weaving mills, trade dyers, finishers and textile printers. In 1948-49 the employment sizes of the 153 establishments were as follows—

Factory Size	Factories	Persons Employed	Factory Size	Factories	Persons Employed
persons	no.	no.	persons	no.	no.
Up to 10	29	180	201 to 300	16	4,081
11 to 20	22	318	301 to 400	7	2,370
21 to 50	21	627	401 to 500	4	1,675
51 to 100	20	1,495	501 to 750	6	3,303
101 to 200	21	3,027	751 and over	7	7,854
Totals				153	24,930

It will be noticed that the greater part of the employment was in the larger establishments. The 40 mills each employing more than 200 persons employed 19,283 of the total of 24,930 persons. The 13 mills each employing more than 500 persons employed 11,157 persons, nearly half of the total employed in the industry.

Total employment in September, 1951, was about 23,600 persons and has fallen by about 30 per cent. since. On the basis of employment, over 50 per cent. of the industry is concentrated in Victoria, about 30 per cent. in New South Wales and about 5 per cent. in Tasmania. Firms engaged in spinning and weaving employ, on the average, a larger number than those engaged only in other processes.

Structure of the Wool-textiles Industry in Detail

The following narrative presents in more detail the structure of the industry—

SCOURING AND CARBONISING: There are 46 establishments engaged in scouring and/or carbonising as a principal activity; 36 of these are scourers only, three are carbonisers only and seven both scour and carbonise. Of the 36 scourers, 14 also fellmonger (see also "Fellmongery", Chapter 14); one is primarily engaged in stock killing and meat canning. A number of the scouring and/or carbonising establishments are independent firms or are associated with wool brokers. Three of the larger companies, which both scour and carbonise, are subsidiaries of Felt & Textiles of Australia Ltd. (see also page 404). The scourers and carbonisers work both on commission and on their own behalf, largely for export. Part of their processing operations are on commission for overseas buyers of greasy wool and for the wool mills in Australia which do not scour or carbonise. In addition to the above establishments, there are about 35 wholly or partly integrated wool mills which scour and/or carbonise. Seven of these are topmakers (four of them both scour and carbonise, three scour only); 11 other mills both scour and carbonise; nine mills carbonise only; seven mills scour only. One knitting mill scours (and also spins worsted yarn). Most of the nine wool mills which are described as carbonising, but not scouring, do occasionally produce scoured wool, but amounts are small. Of these 35 partly or wholly integrated wool mills, some 24 normally consume all the clean wool they produce. The remainder either sell that surplus to their own requirements, or undertake some scouring and/or carbonising on commission.

TOPMAKING: There are seven companies, each with one topmaking establishment, which produce wool tops (from greasy wool onwards), catering for those worsted manufacturers which do not make their own tops, and for the export trade. This group of topmakers would probably account for about one-half of the total production of tops in Australia. One topmaker is a subsidiary of another (which also fellmongers and tans). One is associated with a worsted mill integrated from spinning onwards. One is a subsidiary of Felt & Textiles of Australia Ltd. (see also page 405). (Four topmakers have fellmongery capacity; two of these also have some tanning capacity.) Commission scouring is done by some of the topmakers. In addition to these seven topmakers, here are twelve partly or wholly integrated worsted mills which make tops, and some others have recombing capacity. Three of these twelve mills also sell tops to the trade or for export. Some of the others occasionally make tops for sale.

WORSTED SPINNING: There are eleven companies, each with one spinning establishment, which are engaged in worsted spinning, but not in later processing. Nine of these manufacturers engage only in the worsted-spinning process; they are medium to small in size compared with worsted-spinning capacity in integrated mills or knitting establishments. Of the other two manufacturers, one, Patons & Baldwins (Aust.) Ltd., which also scours and combs, is the largest Australian manufacturer of fingering yarn, and is an associate of a leading United Kingdom worsted-yarn manufacturer; the other, which also scours and combs, is principally a large meat-killing and meat-packing company, also operating a fellmongery. There are eight knitting establishments (one of which also combs) which have worsted-spinning capacity (see Chapter 16 for comment on knitting). In addition, 30 partly or wholly integrated mills have worsted-spinning capacity—see below. The companies wholly or mainly engaged in worsted spinning and the worsted spinner/knitters have, it is estimated, about 30 per cent. of the worsted spindles in Australia. **Fingering Yarns** are made by four companies only: Patons & Baldwins (Aust.) Ltd. (see above); one spinner/knitter; one spinner/knitter/weaver; and one spinning/weaving/dyeing/finishing establishment, which obtains tops from an associate company engaged in scouring, topmaking and fellmongery. Three of these also supply machine yarns to the trade.

WOOLLEN SPINNING: There are five companies, each with one establishment, engaged only in spinning woollen yarn. One spins only carpet yarns for its parent company. One is a subsidiary of Felt & Textiles of Australia Ltd. (see also end of this Part) and spins only carpet yarns. Three are small companies, one also engaged in warp knitting and one in textile-waste processing. It is estimated that these companies operate about 3 to 5 per cent. of the woollen spindles in Australia. There are, in addition to the above, 36 partly or wholly integrated mills which spin woollen yarn—see below.

WOOLLEN MILLS—

Two manufacturers spin woollen yarn and weave woollen fabric.

Eleven manufacturers spin, weave, dye and finish.

Four manufacturers carbonise, spin, weave, dye and finish.

One manufacturer scours, spins, weaves, dyes and finishes.

Four manufacturers scour, carbonise, spin, weave, dye and finish.

It is estimated that these 22 manufacturers, each with one establishment, operate about 45 per cent. of the woollen spindles and about 15 per cent. of the looms in Australia. Products include woollen yarn, mostly for own use, tweeds, serge, flannel, blankets, rugs, coatings, overcoatings, furnishing fabrics, dress materials, saddlery cloths and some union cloths.

WEAVING ONLY—WORSTED AND/OR WOOLLEN: There are about 44 manufacturers engaged wholly or mainly only in weaving of wool fabrics. Of these manufacturers, 10 normally concentrate on weaving woollen fabric only, about 11 normally only on worsted fabrics, and about 23 normally undertake both worsted and woollen weaving. (It is, however, difficult to fix any sharp line of demarcation, as all 44 manufacturers can weave either worsteds or woollens, and are inclined to switch from one to the other, depending on demand for cloths and/or supplies of yarns.) A few of these manufacturers are large, but most are small, some having less than 10 looms each. ("Backyard" weavers, operating a power loom or two, usually spare-time and on commission, are not included in this survey.) Commission weaving is frequently undertaken, a few mills appearing to be solely on commission work. Finishing is done by trade finishers and by some integrated mills which also do commission finishing or which are associated with the weaver requiring cloth to be finished. Of the 10 woollen weavers, one is a hand weaver engaged in commercial production; most of these weavers are small, and those with machine looms operate, it is estimated, about 3 per cent. of the total looms in the industry. Most of the 11 manufacturers normally weaving only worsted cloths are small in size; one is the only manufacturer in Australia of wool-pile moquette (uncut) for upholstery, and another is a subsidiary of an integrated worsted mill, and specialises in high-quality worsted suitings. Three of the 23 manufacturers normally weaving both worsted and woollen fabrics each has a small amount of woollen-spinning plant. About five manufacturers are hand weavers engaged in commercial production. Three or four of the manufacturers also weave cotton/wool union cloths and cotton cloths, including tweeds and tapestries. The manufacturers engaged only in worsted and/or woollen weaving have, it is estimated, about 15 per cent. of the looms of the wool industry, and a negligible proportion of the woollen spindles.

WORSTED MILLS—

Five manufacturers with 6 establishments, spin worsted yarn and weave worsted cloth. One of these also weaves worsted/hair and cotton/hair interlinings. One is an associate company of a large hosiery and rayon weaving company. One, at a separate establishment, also knits. One sells a little worsted yarn to the trade.

Five manufacturers, with 8 establishments, spin, weave, dye and finish.

Four manufacturers, with 6 establishments, scour, comb, spin, weave, dye and finish. One is associated with another of the three, and has a subsidiary engaged in weaving fine worsted cloth.

These 14 manufacturers have, it is estimated, about 50 per cent. of the worsted spindles and 33 per cent. of the looms operated by the wool industry.

The greater part of Australian wool manufacturing capacity is within these two main groups of mills. As a composite group it probably has 70 per cent. of the worsted spindles, 50 per cent. of the woollen spindles, and 66 per cent. of the looms. Some of the mills are owned or controlled by wholesale or retail organisations; two large mills (one of them also a knitter) are each owned by a large departmental-store company. Products of the 30 manufacturers in this composite grouping include worsted and woollen yarns for weaving, machine knitting and fingering yarns, worsted dress and suiting cloths, gabardine, tie cloths, tropical suitings, and woollen piecegoods, rugs and blankets.

INTEGRATED WORSTED AND WOOLLEN MILLS—

One manufacturer spins worsted and woollen yarns, weaves worsted and woollen cloths, dyes and finishes. This company has its scouring, carbonising and topmaking done by specialist associate companies.

One manufacturer combs, spins worsted and woollen yarns, weaves worsted and woollen cloths, dyes and finishes.

One manufacturer scours, spins worsted and woollen yarns, weaves worsted and woollen cloths, dyes and finishes.

Five manufacturers carbonise, spin worsted and woollen yarns, weave worsted and woollen cloths, dye and finish. One of these is owned by a co-operative group.

Three manufacturers scour, carbonise, spin worsted and woollen yarns, weave worsted and woollen cloths, dye and finish. One of these companies is controlled by a large departmental store.

One manufacturer scours, combs, spins worsted and woollen yarns, weaves worsted and woollen cloths, dyes and finishes.

Four manufacturers, with 8 establishments, scour, carbonise, comb, spin worsted and woollen yarns, weave worsted and woollen cloths, dye and finish. One of these is a large producer of fingering yarn, also making knitted garments, and is controlled by a large departmental store.

These 16 manufacturers have, it is estimated, about 20 per cent. of the total worsted spindles, 50 per cent. of the total woollen spindles, and about 33 per cent. of the looms operated by the wool industry.

DOUBLING AND WINDING: There are about five small operators engaged only in the doubling and/or winding of wool yarns, usually on commission. Some spinners and integrated mills also undertake commission doubling and winding.

PRINTING OF WOOL FABRICS: One processor provides a printing service particularly for wool fabrics. One wool mill, which produces blankets, also prints motifs and animal figures on children's and babies' blankets.

COTTON TEXTILES—Preparation, Spinning, Doubling, Mercerising, Weaving, Braiding, Dyeing, Printing and Finishing

INTEGRATION: There are about 95 establishments in Australia engaged primarily in the processing and fabricating of cotton. The spinning and weaving of cotton yarns and cloth is dominated by a small number of large firms, operating numerous establishments. About 90 per cent. of the cotton spinning capacity is operated by five large companies, namely—

Australian Cotton Textile Industries Ltd., Adelaide, S.A.

Bonds Industries Ltd., Sydney, N.S.W.

Bradford Cotton Mills Ltd., Sydney, Newcastle and Rutherford, N.S.W., and Melbourne and Bendigo, Vic.

Davies Coop & Company Ltd., Melbourne and Stawell, Vic., Adelaide, S.A., Sydney, N.S.W.

Stirling Henry Ltd., Sydney, N.S.W.

and about 80 per cent. of the total cotton weaving capacity is operated by four of these companies (Bonds Industries Ltd. knits, but does not weave, except through a subsidiary towel-weaving company). Of these five companies, the largest are Bradford Cotton Mills Ltd. and Davies Coop & Company Ltd., which, with their various subsidiary companies, operate between them about two-thirds of the total cotton-spinning capacity and about one-half of the total cotton-weaving capacity in Australia. All of the large companies are fully integrated, processing through all stages from raw cotton to dyed and finished piecegoods, and in some cases also to the made-up article. A considerable proportion of the cotton-knitting capacity is also contained in these large spinning and weaving mills. (See Chapter 16 for knitting.) Davies Coop and Co. Ltd. is establishing a new subsidiary company, Davies Coop (B.D.A.) Pty. Ltd., to operate a dyeing and finishing plant which will have available to it the processes of Bradford Dyers' Association Ltd., U.K. The latter company is to take up a substantial shareholding in Davies Coop and Co. Ltd.

PRINCIPAL MACHINE EQUIPMENT: The following table provides an outline of principal machine equipment in cotton-textile mills (excluding knitting) in Australia, and shows expansion over recent years compared with 1938-39—

	Carding	Combing	Spindles	Twisters	Warpers	Looms
	no.	no.	no.	no.	no.	no.
1938-39	455	20	91,148	61	59	1,251
1945-46	891	21	191,047	177	111	2,671
1946-47	872	33	195,641	214	130	2,993
1947-48	876	32	195,014	204	111	3,049
1948-49	920	34	201,315	240	133	3,312
1949-50	1,021	35	215,223	213	119	3,390
1950-51	1,100	15	237,222	233	80	3,543

EMPLOYMENT SIZE OF MILLS: In 1949-50 there were 93 establishments, and in 1948-49 91 establishments, wholly or mainly engaged in one or more of the processes of cotton spinning, doubling/winding/mercerising, etc., weaving, braiding, including associated dyeing, finishing, printing, proofing, etc., when carried on in an integrated cotton mill, and including spinning sections of knitting mills. In 1948-49 the employment sizes of the 93 establishments were as follows—

Factory Size	Factories	Persons Employed	Factory Size	Factories	Persons Employed
persons	no.	no.	persons	no.	no.
Up to 10	28	165	101 to 200	9	1,371
11 to 20	11	154	201 to 300	5	1,304
21 to 50	22	723	301 to 400	2	637
51 to 100	9	674	401 and over	5	3,224
Totals				91	8,252

It will be noticed that the greater part of the employment was in the larger establishments. The 12 mills each employing more than 200 persons employed 5,165 of the total of 8,252 persons. The 5 mills each employing more than 400 persons employed a little more than one-third of the total employed in the industry. The average number of persons employed in the year 1950-51 was 9,233. On the basis of employment, nearly 50 per cent. of the industry is located in New South Wales and about 35 per cent. in Victoria.

Structure of the Cotton-textiles Industry in Detail

The following description shows in detail the structure of the industry—

COTTON GINNING: There are two cotton-ginning plants, which gin the small Australian crop and treat the resultant (and some imported) cotton seed. The cotton ginneries are operated by a State Government body, and are situated in Queensland near the cotton-growing areas. In 1949-50 and 1948-49 the number of persons employed was 29 and 33.

SPINNING (including Doubling): There are two firms engaged only in spinning cotton yarn, and not in subsequent processing. One of these, located in Queensland, uses the major portion of Australian-grown cotton. Both are fairly small establishments. Most of the cotton yarn is spun and doubled in large integrated mills—see later this Part. Most cordage mills double cotton yarn for cotton cordage, but no cordage mills spin cotton yarn. Twisting of cotton yarn for manufacture of sewing threads is discussed later in this Part. **Condenser Yarn** is manufactured by four companies. One small company is engaged only in condenser spinning. The other three are integrated mills—Bonds Industries Ltd., Davies Coop & Company Ltd. and a spinning/towel-weaving mill.

PLASTICISING OF COTTON YARN: There are two establishments engaged in the plasticising of cotton yarn, both of which are subsidiaries of two of the large integrated cotton mills.

SPINNING ASSOCIATED WITH CANDLEWICK TUFTING (CHENILLE): One chenille company, which has three branch factories, spins some of its cotton-yarn requirements. This company has announced its intention of substantially expanding its spinning capacity, and has commenced to weave cotton cloth. (Four other companies produce chenille and chenille products, but do not spin yarn. One of these, with two branch factories, doubles cotton yarn, but does not spin. See "Candlewick-Chenille", Chapter 17.)

INTEGRATED COTTON MILLS: There are ten companies operating, between them, at least 30 establishments which in collective effect carry out all of the processes of cotton preparation and spinning, doubling, winding, weaving, dyeing (both yarn and piecegoods), bleaching, finishing (and also knitting of fabric and garments and making up of garments and other articles). These companies are described below—

Australian Cotton Textile Industries Ltd., with one mill, is the only manufacturer of bleached sheeting and pillow casing. It spins all its own requirements of cotton yarn and sells small quantities of yarn to the trade. In addition to sheeting and pillow casing, this company weaves towels and towelling and head cloth, and makes up sheets, pillow slips and baby squares. It has its own bleaching, dyeing and finishing plant. The company operates about 8 per cent. of total cotton-spinning capacity in Australia and about 10 to 15 per cent. of cotton-weaving capacity.

Bonds Industries Ltd. has three branch factories, and a subsidiary company engaged in weaving towels and towelling (one of the largest towel-weaving plants in Australia). The company spins all of its own, and the subsidiary towel company's, requirements of cotton yarn and condenser yarn and sells considerable quantities to the trade. Both dyed and undyed yarn is produced. Other products made include sewing thread, knitted rayon, wool, cotton and mixture piecegoods, stockinette, fully-fashioned nylon and silk hosiery and worsted half-hose. It makes up underwear and other knitted garments. This company operates about 10 per cent. of total Australian cotton-spinning capacity.

Bradford Cotton Mills Ltd. has nine subsidiary companies in its structure. It produces cotton yarn, both dyed and undyed, for its own weaving activities and considerable quantities for sale. Woven cloths produced include canvas and duck, webbing, drill, denim, cotton tweed, jeans, dungarees and some light-weight woollen fabrics, and cotton tyreCORD and tyreCORD fabric. The company operates its own dyeing, bleaching, and finishing plants. In addition, the company operates other subsidiaries engaged in sanforising services, plasticising of cotton yarns, and rotproofing of piecegoods. As a group this company operates about 33 per cent. of total Australian cotton-spinning capacity and between 25 and 30 per cent. of cotton-weaving capacity.

Davies Coop & Company Ltd. operates seven establishments. It spins its own requirements of cotton yarn and sells considerable quantities to the trade. It also produces condenser yarn, mop yarn, cotton tyreCORD and tyreCORD fabric. Woven cloths made include canvas and duck, drills, denim, tweed, jeans, dungarees; it is the only Australian weaver of flax canvas and fire hose. This company also produces knitted cotton piecegoods and garments and makes up knitted underwear and outerwear garments. It operates its own dyeing, bleaching, rotproofing (for canvas) and finishing plants. In all, the company operates about 33 per cent. of total Australian cotton-spinning capacity and some 25 to 30 per cent. of cotton-weaving capacity.

Stirling Henry Ltd. operates about six establishments (all, however, at the one site). It spins cotton yarn, weaves cotton drill, tweeds and cotton/wool union piecegoods, knits cotton garments and piecegoods and makes up knitted outerwear and underwear and woven industrial garments (mainly overalls). It has its own dyeing and finishing plants. The company operates about 6 per cent. of total Australian cotton-spinning capacity and about 5 per cent. of cotton-weaving capacity.

One manufacturer spins cotton yarn and condenser yarn and weaves towels and towelling. It has its own dyeing plant.

One manufacturer spins cotton yarn and weaves furnishing fabrics.

One manufacturer spins cotton yarn and produces wool-and-cotton union cloths.

One manufacturer is mainly a spinner and knitter of wool products, but has a section which spins cotton yarn and knits cotton, cotton/wool and other union knitted piecegoods, and makes up finished garments.

One manufacturer spins cotton yarn and weaves cotton and cotton/wool union piecegoods.

WEAVING ONLY (not Narrow Fabrics): There are about 30 manufacturers in Australia which are engaged only in weaving of cotton, and not in other processes. Six of these produce only towels and towelling. Fourteen are mainly concerned with production of cotton piecegoods such as drills, ducks, cotton tweeds, furnishing fabrics, etc. Some companies also produce union cloths. Most of the cotton yarns used by these weavers are obtained from the large integrated mills.

TYRECORD AND TYRECORD FABRIC: Bradford Cotton Mills Ltd. and Davies Coop & Company Ltd. are the only producers in Australia of cotton tyreCORD and tyreCORD fabric. Each of these companies has two establishments engaged in tyreCORD production.

SEWING COTTON AND THREAD: There are about 9 manufacturers producing sewing threads. Only one spins; the remainder confine their activities to doubling, winding, dyeing, mercerising and gassing, packaging, etc. Five manufacturers make sewing thread for industrial purposes, and four of these also make for household use. One also makes hand-knitting yarn, and this manufacturer and one other make crocheting yarn. Two also make embroidery cottons. One manufacturer (by far the largest Australian producer of sewing thread) also weaves rayon cloth.

NARROW FABRICS AND BRAIDS: There are about 20 manufacturers producing narrow fabrics and braids. Most of these are fairly small, operating from only 5 or 10 looms up to about 50 looms; one is a subsidiary of Felt & Textiles of Australia Ltd. (see also page 405); one other is a branch of a United Kingdom narrow-fabrics company. Although these companies are principally engaged in the manufacture of cotton narrow fabrics, some also weave rayon ribbons, etc. The industry is engaged in weaving of narrow fabrics and tapes, slitting, braiding of electric wires, some embroidering and some printing. Products made include cotton tying tapes, webbing tapes from $\frac{1}{2}$ inch to 2 inches wide, printers' tapes, woven cotton belting, webbing for canvas-goods trade, swimsuit belts, tapes for slide-fasteners, electrical-trade fancy printed tapes 1 inch wide, industrial tapes, galloons $\frac{1}{2}$ inch to 1 inch wide, name tapes, label tapes, bindings and shoe laces, rayon and satin ribbons from $\frac{3}{8}$ inch to 3 inches wide, hatbands and petershams. Circular products of rayon or cotton include pyjama girdles, braids, fringes, tassels and shoe laces.

RAYON, SILK, NYLON TEXTILES

There are about 17 manufacturers engaged in the throwing of rayon, nylon and/or silk, and in the weaving of rayon fabrics (including narrow fabrics), in Australia. (No weaving of silk or nylon fabrics is done in Australia at present, though parachute silk was woven by two companies during the 1939-45 War.) No rayon filament or staple fibre is made in Australia; one English company, in association with Australian interests, is building a plant to produce rayon filament for twisting into tyre cord. Official statistics for the rayon, nylon and silk textiles industry (excluding knitting) record 20 establishments wholly or mainly engaged in 1949-50 and 17 establishments in 1948-49. Of the 1948-49 establishments, none employed less than 11 persons, 6 each employed 11 to 20 persons, 5 each from 21 to 50 persons, 2 each from 51 to 100 persons, and 4 each more than 100 persons; these 4 establishments employed 1,446 persons out of an industry total of 1,858. Details of the structure of the industry (at early 1952) are as follows—

THROWING (TWISTING) AND DOUBLING (of Hank Silk, Rayon Spinning Cake and Nylon Filament): There are three manufacturers engaged in the throwing and doubling of yarn; two of these are associated with rayon-weaving companies, and one of the two operates three throwing establishments. All throwsters undertake commission throwing and doubling. In addition to these three throwsters, several large hosiery mills operate their own throwing sections.

NARROW FABRICS: There are eight manufacturers engaged in weaving rayon narrow fabrics. One, the largest producer of ribbons in Australia, is an associate of a large rayon-weaving company.

WEAVING: There are six manufacturers in Australia engaged in the weaving of rayon fabrics. One is a subsidiary of a large hosiery and knitting mill; one is associated with a Canadian rayon-weaving firm; one is associated with a large U.S.A. cotton-weaving and rayon-weaving firm; and two are associated with United Kingdom firms. A seventh manufacturer, also associated with a United Kingdom firm, will shortly commence weaving rayon fabrics. Two of the manufacturers are large; three (including the one about to commence) are of medium size, with about 100 looms each; and two are small, with perhaps 20 looms each (one of these two is the largest Australian manufacturer of sewing threads). In addition to these manufacturers, there are three others which weave rayon fabrics as a lesser activity in conjunction with the weaving of other fabrics (cotton or wool).

FLAX

DESEEDING, RETTING, SCUTCHING, SORTING, GRADING: These processes are carried out by twelve mills, located near flax-growing areas. Eleven of the mills are owned and operated by the Commonwealth Government, the other is owned by the State Government of Western Australia and is operated by a co-operative company. These mills are fairly small, none employing less than 20 persons and none more than 100 persons. (Australia's flax crop is not large.)

SPINNING: There are three companies in Australia which hackle and spin flax yarns, and one other company which spins, but does not hackle. These mills, all cordage mills, spin flax yarn mainly for their own use in the manufacture of linen thread and flax twine. Two of them sell flax yarns to other users.

WEAVING: Davies Coop & Company Ltd. (one of the largest cotton-spinning and cotton-weaving companies—see "Cotton", above) is the only company in Australia which weaves flax. It produces flax canvas and fire hose.

OTHER TEXTILE ACTIVITIES, AND FELTING

The activities of trade dyeing, finishing and printing, carpeting manufacture, wool felting, hair felting, hair weaving, coir weaving and jute weaving, are listed below, with, where known, the number or an approximation of the number of manufacturers engaged in each activity. In

official statistics those activities, where carried on as a sole or major activity, are grouped into a miscellaneous sub-class of statistics with activities such as manufacture of candlewick-chenille, waddings, paddings, surgical dressings, processing of textile wastes, manufacture of flock and needled felts, of netting and nets, and of miscellaneous products based on textiles, felts or cordage. (See also Chapter 17, "Products of Textiles and/or Wastes, Cordage, Hair, Felt, Not Elsewhere Included".) In 1949-50 there were 155 establishments wholly or mainly engaged in activities within the above miscellaneous grouping, and in 1948-49 120 establishments. Of the 1948-49 establishments, 45 each employed up to 10 persons, 26 each from 11 to 20 persons, 22 each from 21 to 50 persons, 12 each from 51 to 100 persons, and 5 each more than 100 persons. Out of the 1948-49 total of 3,232 persons employed in such activities, the 17 largest of the 155 establishments employed 1,783 persons, over half of the total. Details of structure of some of the activities within the miscellaneous textiles grouping are set out below (the remainder of the activities within the grouping being included in Chapter 17)—

TEXTILE DYEING, PRINTING, FINISHING: There are about eighteen companies in Australia wholly or mainly engaged in the dyeing, printing and/or finishing of textile products. These companies mainly operate as a trade service to the textile industries, but some buy local or imported cloths and print them on their own account, for sale. Nine of the eighteen companies are associated with textile mills, but are operated as separate organisations, processing textiles for other firms than their associates. Services available to the textile trade include mercerising, piece-scouring, crease-resisting, bleaching, dyeing (yarn and piecegoods), tentering, pressing, shrink-proofing, rotproofing and printing. Some finishing of knitted products is also done by these firms. In addition to these eighteen companies, practically all of the large integrated wool and cotton textile mills and most of the large hosiery and knitting mills have their own dyeing and finishing plants.

CARPETING: There are four manufacturers of carpeting in Australia, employing, in total, about 900 persons. Three companies make woven carpeting and one makes a Brussels carpeting with hair/wool loop pile fixed to hessian by rubber. Practically all raw materials—jute, cotton, coarse wool, hessian and hair—are imported; jute yarns, cotton yarns, woollen pile-yarns and linen thread, and a small quantity of hessian, are made in Australia. Chenille Axminster, tapestry and ingrain carpeting are not made in Australia, and worsted pile-yarns are not used. Details of the four manufacturers are as follows—

One company, the largest manufacturer of carpeting in Australia, with one mill, is equipped with 27-inch and 36-inch spool Axminster looms and 27-inch, 36-inch and 40-inch Wilton looms. The carpeting produced—body, runner ("stairs"), corridor rugs, hearth rugs—consists of patterned Axminster, plain, stippled and patterned Wilton, and woollen Brussels. Spool Axminster looms, 9 feet wide, are being installed for production of broadloom and squares. No spinning is carried on; hank-dyed woollen pile-yarns are supplied by an associate company. This company is a subsidiary of Felt & Textiles of Australia Ltd. (see also page 405), a large United Kingdom carpet manufacturer also has a shareholding.

One company, with one mill, is equipped with 27-inch Axminster spool looms and 27-inch Wilton looms. Only body carpeting is produced, consisting of patterned Axminster, plain, stippled and patterned Wilton, and woollen Brussels. The weaving plant is being extended with more 27-inch spool looms and by conversion of some plain Wilton looms to jacquard looms. The company itself spins its woollen pile-yarn requirements, fleece-dyed, and is preparing to hank dye. This company is associated with a woollen and worsted spinning/weaving/finishing company.

One company, with one mill, is equipped for Axminster only, and has 27-inch and 36-inch gripper looms and 27-inch, 36-inch, 7 feet 6 inches and 9-foot spool/gripper looms. Products are plain carpeting (in high grades only) and patterned body, runner ("stairs"), rugs, broadloom and squares. Spool/gripper looms, 12 feet wide, are to be installed. Undyed yarns are obtained from a subsidiary woollen spinning/weaving/finishing mill (making blankets, rugs, tweeds, etc.), and hank dyed at the carpet-weaving mill.

One company, with one mill, makes 40-inch body carpeting, overall coloured, not patterned, with a hair/wool Brussels pile fastened to hessian by a rubber solution. (The company does not weave hessian.)

WOOL FELTS AND HARD HAIR FELTS (excluding Needled Felts): The wool-felt industry in Australia (excluding wool-felt hoods for hats—see Chapter 16) consists of four unassociated companies, one of which has three subsidiary companies also engaged in wool-felt manufacture. (The manufacture of needled hair and jute/hair felts is covered in "Needled Felts", Chapter 17.) Details of the four manufacturers are as follows—

Felt & Textiles of Australia Ltd., with three of its subsidiary companies, is the principal manufacturer of wool felts, and also of hair felts. The parent company, at two establishments, makes plain, mottled and printed flooring felts, engineering, piano, slipper, dress and millinery felts, and saddle felts, etc. At a third establishment, the parent company makes hard hair felts (and also needled jute/hair underfelt, insulating and padding felts); and at a fourth establishment, is engaged in stuff cutting of hair felts for the footwear industry. One subsidiary company, at one establishment, makes plain flooring felts, slipper, engineering, motor-vehicle body-lining felts, and saddle felts (and needled jute/hair felts). A second subsidiary company, with one establishment, makes tailoring, slipper and millinery felts. A third subsidiary company,

with one establishment, makes flooring, slipper, motor-vehicle body-lining felts, and similar felts. (See also pages 402-406 for a full description of the activities of Felt & Textiles of Australia Ltd., and its associate companies—including the cutting and further processing of felt into a wide range of felt products and slippers.)

One company, with one establishment, makes mottled flooring felts, slipper felts, industrial plain felts and components—cut, laminated, formed, etc.—from industrial felt. (This company also makes needled jute/hair flooring underfelt and insulating felt, and a synthetic-rubber floor-covering. It also owns three slipper-making businesses.)

One company, principally a cordage manufacturer, with two establishments, also makes at one of the factories plain flooring and industrial felts, slipper and millinery felts, and hard hair felt (and also makes needled jute/hair underfelt and insulating felt).

One company, principally a manufacturer of woollen textiles, with one establishment, has capacity for the manufacture of slipper and floor felts, but has not produced any felt since 1939, although it may possibly re-enter this field.

CROCHETED FABRICS: There are several companies, mostly unassociated with the textiles industry proper, engaged in this type of activity. Products include dishcloths, sweatbags, curtain netting, laundry-bag netting (and making-up of bags), open-mesh blankets, quilts and shawls from cotton, wool, rayon and mixtures, and pyjama cords.

ELASTIC AND ELASTIC FABRICS: About ten companies are engaged in weaving or braiding elastic in Australia; of these, three produce corset fabrics, and about seven produce elastic tapes and braids in various widths. One is associated with a U.S.A. company making elastic and elastic fabrics.

LACE, BRAIDS, EMBROIDERIES, MISCELLANEOUS TEXTILES: There are about 100 establishments in Australia engaged in one or more of these activities. A large number of these firms are very small, and would not be regarded, for statistical purposes, as a factory. No lace is manufactured in Australia, the only activity of this type being the manufacture of embroidered lace-like fabrics and edgings. There is only one manufacturer with fully-automatic embroidery machines; this company, a subsidiary of Felt & Textiles of Australia Ltd. (see also page 405), makes embroideries in the piece, including broderie anglaise and needlerun, embroidered badges and motifs, woven labels and signs, specialised shoe and slipper trimmings (as well as quilted fabrics and knitted fabric for laundry steam-press paddings and dyebags, and makes up dyebags). Many of the smaller firms concentrate on commission work (i.e., to special order); a number specialise in a particular type of work—for example, lodge regalia. A large amount of work, particularly for the smaller firms, is done on a part-time basis by women working in their own homes. Products made by this industry include embroidered fabrics in the piece, broderie anglaise, embroidered lace-like edgings, badges, labels, motifs, regalia and trimmings of various types, etc.

HAIR PREPARATION: There are about six processors engaged in hair preparation—one entirely for hair felts, the others for upholstering and brushmaking (see "Furniture, etc.", Chapter 3, "Timber Preparation, Products of Wood, Cane, Bark, Cork, Straw", for comment on hair preparation for upholstery and brushmaking). The processor preparing hair for hair felts is a subsidiary company of Felt & Textiles of Australia Ltd. (see also page 404), and is engaged entirely in collecting and, at two establishments, in washing and drying of bovine body hair for use by the parent company (hard hair felt and needled jute/hair underfelt and insulating felt) and three associated companies making needled jute/hair felts. Two tanneries collect for sale the bovine body hair resulting from their operations, but do not treat it in any way.

HAIR WEAVING: There are only three companies in Australia engaged in the weaving of hair fabrics. Their activities cover the weaving of imported goat-hair yarn mixed with cross-bred woollen yarn or of imported mohair yarn into clothing interlinings. (No hair yarns are spun in Australia.) One company is associated with a United Kingdom manufacturer of interlinings.

COIR WEAVING: Loom and frame-made matting and rod-loom and frame-made mats are principally the manufactures of Australian penal establishments and institutes for the care of blind persons. All yarn is imported, dyed and undyed, ready for use.

JUTE WEAVING: One small firm recently commenced (in 1951) the weaving of jute piece-goods, for use in the manufacture of carpeting. This firm has three looms engaged in weaving jute, and also produces woollen piecegoods and blankets. Jute yarn is obtained from Australian cordage manufacturers.

CORDAGE

There are about 26 establishments in Australia wholly or mainly engaged in the manufacture of cordage. Seven manufacturers with integrated mills operating from raw fibre to finished

cordage make up most of the industry. Products made include manilla and coir ropes, doubled and braided cotton cords, sisal twines and ropes, flax yarns (see "Flax Spinning", earlier this Part), linen sewing threads (three manufacturers only), flax twines, and jute yarns, twines and lashings. One mill also makes fishing lines. Some of the mills also make nets (by hand netting), plough reins, halters, grummets and other products from cordage. Manufacturers of cordage in Australia are, generally, unassociated in company structure with each other and with other industries, and usually make only cordage. One company is associated with one of the world's largest linen-thread manufacturers. (This company is preparing to make fish netting in Australia, an important activity of the overseas group.) One of the largest cordage companies has two large establishments, one of which was recently erected in a Victorian country area (and is reported to be the most modern mill in Australia). One other company, which has two establishments, also makes wool felts (plain flooring, industrial, slipper, millinery), hard hair felt, and needled jute/hair underfelt and insulating felt. The employment sizes of the 26 establishments wholly or mainly engaged in cordage manufacture in 1948-49 were as follows: Thirteen establishments each employed up to 10 persons, 1 from 11 to 20 persons, 2 each from 21 to 50 persons, 3 each from 51 to 100 persons, 4 each from 101 to 200 persons, and 3 each more than 200 persons; the 3 largest mills employed 1,526 and the 10 mills each employing more than 50 persons employed 2,387, out of the industry total of 2,542 persons.

Felt & Textiles of Australia Ltd.

THE processing of greasy wool and the manufacture of wool products in Australia cannot be adequately shown without reference to Felt & Textiles of Australia Ltd., a conspicuous company which, through three of its subsidiary companies, is the largest single processor of greasy wool in Australia, with capacity to process up to 60 million lbs. a year, for export, for commission customers, and for manufacturing activities of the parent company and some of the subsidiary companies.

In 1950-51, a period of very high wool prices, about 40 million lbs. of greasy wool were treated at the three processing works, which supply all the clean wool required for the group's manufacture of wool products in Australia. (A small portion of the wool processed is greasy wool from New Zealand, for manufacture into pile-yarns and carpeting by the group.) The manufacturing activities of the parent company and some of the subsidiary companies also make the group the largest single converter of clean wool to wool products in Australia. In addition, the group is a considerable manufacturer of non-wool products.

The Felt & Textiles group is a remarkable example of company and manufacturing organisation, and comprises one of the largest industrial undertakings in Australia; there are few companies that are larger in capital and labour engaged. The opportunity is taken here to comment on the group and its activities and to show its structure and products in basic detail, not only because of the significance of the group in wool-processing activities in Australia, but also because of the example presented of organisation that is possible within Australian company law.

Development of the group has been rapid, particularly over recent years, due not only to being based on the commonplace indigenous materials of wool, hair and leather and manufacture of products of daily personal, domestic and industrial needs, but also to purchase of going concerns and their development, usually with continuation of existing executive staff, as entities that fit into a general pattern of homogeneity of activity by the group.

The extension of activities to overseas countries is notable, and began early in the group's existence. The development of the New Zealand subsidiary company and the South African associate company has been on parallel lines to development in Australia; and the overseas companies and the Australian group trade with one another in raw, semi-finished and finished materials to mutual advantage.

The F. & T. group originated in a small proprietary company, Sydney Felt & Textiles Ltd., incorporated in 1921, which undertook the manufacture of wool felt piecegoods for the first time in Australia. Paid-up capital

was £6,000 and employment less than 20 persons. In thirty-one years, at 1951, the paid-up capital of the company was £5.3 million (nominal capital £10 million), and the employment was 7,900 persons in manufacturing, distributing and administration. The company operated in Australia, directly or through subsidiary companies, 61 factories and 3 factory-service establishments. Some of the factories are the largest of their type in Australia, most are significant in their activity, and a few are the only factories in Australia making certain products. The broad outline of the company's structure (at early 1952) is as follows—

The parent company is a public company (its first public issue was made in 1937), which, in addition to its holding and central control functions, has remained a manufacturer, operating four factory establishments, and is also a distributor of felt.

There are 37 incorporated proprietary subsidiary companies actively operating in Australia. Twenty-nine of these are primarily or only manufacturing companies, and operate 47 factories. Eight are engaged only in distributing or trading. All except one are owned entirely and directly by Felt & Textiles of Australia Ltd.; the exception is 74 per cent. directly owned.

(The group also has fifteen incorporated companies (one an associate, and not subsidiary) that are dormant because activities and/or assets have been transferred to other subsidiary companies, or projects have not been proceeded with.)

There are 14 unincorporated businesses actively operating in Australia, owned and controlled by subsidiary companies. Ten of the businesses, operating 10 factory establishments, are manufacturers; three, operating 3 establishments, are maintenance, service or supply businesses; and one is a distributing business for the subsidiary company which owns and controls it.

There is one associated incorporated proprietary company, which operates two establishments, actively manufacturing in Australia, in which Felt & Textiles of Australia Ltd. owns directly a 25 per cent. shareholding.

There are also minor interests not included in this description.

Felt & Textiles has also established itself in a large way in New Zealand and South Africa.

Felt & Textiles of New Zealand Ltd. is a public company in which Felt & Textiles of Australia Ltd. holds 52 per cent. of the ordinary capital. The holding has become, in effect, an investment of the parent company, as the New Zealand company operates autonomously. The New Zealand organisation includes three incorporated proprietary subsi-

diary companies and eleven businesses engaged in manufacturing, and also a few non-manufacturing companies. Activities include wool scouring and carbonising, manufacture of felts, carpeting, footwear, medical bandages, cottonwool and braided laces, textile-wastes treatment and processing of woolled skins.

Felt & Textiles of South Africa Ltd. is a public company, in which Felt & Textiles of Australia Ltd. holds a 41 per cent. share of the ordinary capital. The company has five subsidiary companies engaged in manufacture and four others not manufacturing. Its activities include the manufacture of felts, footwear, carpeting, medicinal cottonwool and bandages, boxmaking and printing, and textile-wastes processing.

ACTIVITIES IN AUSTRALIA

Operations in Australia of the group are entirely integrated. Each unit operates as an entity, and relies on other units for raw and intermediate materials, and on the parent company for specialised advisory and other services with regard to finance, technical processes and marketing. The group has several licensing arrangements with overseas manufacturers, particularly for footwear styles to be made in Australia, and makes in Australia for one U.S.A. footwear manufacturer that itself distributes through a subsidiary distributing company the products made in Australia. Financial participation by overseas companies in manufacturing activities by F. & T. Australia (which includes F. & T. New Zealand) is quite small relative to total capital in use, and is limited to two activities—carpet making in Australia and New Zealand (the overseas carpet manufacturing company concerned is also associated with F. & T. South Africa), and cottonwool and products therefrom in Australia.

Products made in Australia by the group are clean wool (and unrefined wool grease as a by-product); clean hair; wool felts (including printed felt); hard hair felt; needled jute/hair felt for floor-covering underfelt, insulating felt, padding felt; accessories and components of felt for industrial, technical and domestic use; cut and slit felt; vegetable and synthetic adhesives; combined felt and/or fabrics; treated and formed felt, fabrics, webbing, etc., for trimmings for motor-vehicle bodywork; rubber-coated felt and fabrics; plastics-coated felt and fabrics; dressed fabrics (by filling or impregnating); calendered dressed fabrics; calendered unsupported plastics film and sheet; extruded plastics products; footwear—slippers, casuals, sandals, shoes, boots; wool tops, including roller lapping; woollen and worsted machine-yarns for weaving and knitting; woollen and worsted woven piecegoods; men's and boys' outerwear; woollen pile-yarns; woven body carpeting; camelhair slipper cloth; knitted industrial fabrics (of cotton); dyebags; embroideries in the piece and in badges and motifs (on automatic embroidery machines); hand-embroidered badges; woven labels and signs; shoe and slipper

trimmings; quilted fabrics for slippers and garments; quilted garments; quilted upholstering materials; blanket (quilted) insulation; quilted camp-mattresses, sleeping-bags, mattress overlays; folding camp-beds; braided products—laces, sleeveings, fancy cords; woven cotton tapes of heavy construction; cottonwool, including medicinal absorbent and non-absorbent, and waddings and paddings of cottonwool; absorbent/soluble sanitary towels (from imported cellulose wadding); broken-down materials from fibre wastes and textile wastes (including mungo and shoddy blends when required); waddings and paddings from wastes; flock.

At first sight there appears to be marked heterogeneity of activity by the group, but apart from a minority of activity which is naturally incidental or for which there is historical reason, there is in fact a homogeneity of activity with which the group sustains itself. However, the homogeneity is not self-sufficient in all types of the main materials used within the group; notably absent is the manufacture of leather for supply to the footwear factories.

The dressing of woolled sheepskins was entered into in a large way during 1939-45 War for making up into sheepskin vests for Armed Services use. Post-war products made by the group from woolled sheepskins and lambskins were, initially, woolled slippers, insoles, rugs, soft toys, coatings, women's coats (curly-lamb and mouton), polishing pads and dusters, trimmings; but rising prices of wool made the activity uneconomic, and by 1951 the group had disposed of its assets in the activity. Clothing interlinings were woven by the group in the post-war period, but manufacture has ceased and the plant has been sold. Tennis-ball cloth was made for a period, but manufacture has now ceased and the looms used for other fabrics. Other abandoned manufacturing activities entered into in recent years were for bias binding, medical bandages, lanolin and wool-grease derivatives; going concerns were purchased and all after a period of operation by the group were sold as going concerns.

DETAILS OF F. & T. COMPANIES AND ACTIVITIES

Details of the activities of Felt & Textiles of Australia Ltd. (at early 1952) are set out below. Some of the companies and businesses, in addition to their manufacturing activities, as shown, are also engaged in trading in the raw materials they use and/or distributing the products they make.

WOOL SCOURING AND CARBONISING: Three subsidiary companies are wholly engaged as wool scourers and carbonisers (at Sydney, Melbourne and Adelaide), each with one establishment. One of the companies has the largest scouring works in Australia, the works adjoining those of an associate subsidiary company making wool tops (see below). The three scours also treat their scour liquors to recover wool grease, which is sold unrefined.

HAIR PREPARATION: One subsidiary company (of which F. & T. of A. Ltd. for many years held a half interest until recently, when the other half interest was purchased), with two establishments (at Sydney and Melbourne), is wholly engaged in collecting bovine body hair from tanneries and washing and drying the hair for the parent company (for hard hair felt and needled jute/hair underfelt and insulating felt) and three associate companies (for needled jute/hair felts).

WOOL FELTS, HAIR FELTS, NEEDLED FELTS AND PADDINGS: Parent company and five subsidiary companies. Details are as follows—

Parent company operates four establishments (all at Sydney). Two of the establishments are wholly engaged in making wool felts—plain, mottled and printed flooring felts, engineering, piano, slipper, dress and millinery felts, saddle felts, etc. The third establishment is wholly engaged in making hard hair felts, needled jute/hair underfelt, insulating felt, padding felt. The fourth establishment, adjoining the third establishment, is engaged in stuff cutting of hair felts and wool felts for the footwear industry.

Three subsidiary companies, each with one feltmaking establishment, make wool felts. One of the companies (at Melbourne) is wholly concerned with wool felt manufacture—tailoring felts, slipper felts, millinery felts, in particular. Another company (at a Victorian country town) makes floor felts, slipper felts, motor-vehicle body lining felts, and similar felts. The other of the three companies is one of the largest and one of the earliest of the subsidiary companies of the F. & T. group in Australia, has four establishments and owns and controls four unincorporated businesses; at its principal establishment (at Melbourne), which is the feltmaking establishment, it makes plain flooring, slipper, engineering, saddle and motor-vehicle body-lining felts, needled jute/hair underfelt and insulating felt and, through one of the four businesses, spins and dyes woollen pile-yarns for carpet manufacture; a second business, with one establishment (at Melbourne), is wholly concerned with making blanket (quilted) insulation, various products of quilted materials, and camp-beds (see Flocks, Waddings, etc., below); a third business, with one establishment (at a Victorian country town), is wholly engaged in manufacture of men's trousers; the fourth business, with one establishment (at Melbourne), is wholly concerned with the generation and supply of steam to two associated companies engaged nearby, one in yarn and fabric dyeing and finishing services, the other making Wilton and Axminster carpeting.

In addition to the parent company and the subsidiary company mentioned above, two other subsidiary companies make needled jute/hair underfelt and insulating felt. One of the companies is principally a manufacturer of footwear and makes the needled felt through an unincorporated business owned and controlled by it, at one establishment (at Perth). The other of the two companies is principally a wastes processor and manufacturer of waddings and paddings from processed wastes (see Flock, Waddings, etc., below).

FELT PRODUCTS, PROCESSED FELT AND FABRICS, PLASTICS FILM AND SHEET, ADHESIVES: One subsidiary company with two establishments (one at Melbourne, one at Sydney) is wholly engaged in the following activities: Cutting and slitting of plain and processed felt for a wide variety of industrial and domestic products; making up of vegetable and synthetic adhesives for own requirements and for trade such as for labelling and packaging work by industry generally; combining of plain and processed felt and/or fabrics; treating and forming of felt, fabrics, webbings, etc., into trimmings for motor-vehicle bodywork; rubber coating of felt and fabrics; plastics coating (P.V.C.) of felt and fabrics (the only plastics coater of felt in Australia); dressing of fabrics by filling or impregnating, and calendering where required (buckram is one such product, the company being the only manufacturer of buckram in Australia); calendering of unsupported P.V.C. film and P.V.C. sheet; extrusion of P.V.C. into products such as shoe randings, motor-vehicle fender pipings, upholstery pipings, and electrical tubing. The Melbourne establishment is engaged in all the above activities. The Sydney establishment, recently opened, is concerned with slitting and cutting of plain and processed felts for industrial and domestic accessories and components, combining of plain and processed felt and/or fabrics, rubber coating of felt and fabrics, and treating and forming of felt, etc., for motor-body bodywork trimmings.

FOOTWEAR: Ten subsidiary companies operating between them twenty-three establishments collectively make a range of footwear of ordinary grades, medium grades and high grades for women (in particular), children and men, with emphasis on all types of slippers and on styled "casual" footwear. Six of the companies and fourteen of the establishments are in Victoria, three companies and six establishments are in New South Wales, and one company and three establishments are in Western Australia. Details are as follows—

One company with three establishments makes women's fashion shoes (at Melbourne); women's casuals and sandals (at Melbourne); women's fashion shoes of U.S.A. licensed styles (at Geelong). Products are distributed by an associate distributing company.

One company with two establishments (at Geelong) makes women's indoor shoes of fabric at one establishment and women's felt slippers at the other establishment. Products are distributed by an associate distributing company.

One company with four establishments makes men's, women's and children's slippers, women's and children's sandals and casuals (at Melbourne); components for previous factory (at a country town near Melbourne); women's and children's slippers, casuals and sandals (at a Victorian country town, through an unincorporated business owned and controlled by the company); men's sandals, football boots, cycling shoes and other men's sports footwear (at Melbourne, through an unincorporated business owned and controlled by the company). The company distributes the products from all its factories.

One company with two establishments makes felt slippers for women and children (at Melbourne) and leather casuals (at a distant suburb of Melbourne). Products are distributed by an associate distributing company.

One company with two establishments makes men's, women's and children's slippers and infants' leather shoes (at Melbourne); and felt slippers (at a Victorian country town). Products are distributed by an associate distributing company.

One company with one establishment (at Melbourne) is concerned only with stuff (stock) cutting in its manufacturing activities—soles, insoles, fillers, platform pieces, stiffeners, toes, toe pieces, heels, etc.—for associate footwear manufacturing companies and the footwear manufacturing trade. The company is also a leather merchant.

One company with three establishments makes slippers in felt for women and men, and women's casual footwear of U.S.A. licensed styles (at Sydney); beach sandals (at Sydney); women's slippers in fabrics, and special types (at a N.S.W. country town). The company distributes all its products other than the licensed casuals through an unincorporated business owned and operated by it; the casuals of licensed design are distributed by an Australian subsidiary company of the U.S.A. licensor.

One company with two establishments makes felt, fabric and leather slippers, casual footwear for women and men, and men's welted footwear (at Sydney); and women's felt slippers (at a N.S.W. country town,

through an unincorporated business owned and operated by the company). The company itself distributes all the non-slipper footwear produced by it, and an associate distributing company distributes the slippers.

One company with one establishment (at Sydney) makes felt and leather slippers for women and children. Most lines are distributed by an associate distributing company, and the other lines by agents.

One company with three establishments makes boots, shoes, felt and leather slippers, for men, women and children (at Perth); boots and shoes for men and boys (at Perth, through an unincorporated business owned and controlled by the company); and felt and leather slippers for men, women and children (at a W.A. country town). Products are distributed by an associate distributing company and by an agent.

WOOL TOPS: One subsidiary company with three establishments (adjoining the works of an associated company engaged in commission wool scouring and carbonising, at Melbourne) directly carries on the merchandising of wool, wool tops and roller lapping, and through an unincorporated business owned and controlled by it is a manufacturer of white and dyed wool tops and roller lapping from the clean wool stage. In addition the company owns and operates two other unincorporated businesses; one is concerned with engineering and plant maintenance services for some of the group's Victorian manufacturing establishments, with construction of some types of machinery for the group, and with a general engineering service outside of group requirements; the other business is concerned with electrical installation and servicing and is a counterpart of the engineering service except that it does not make machinery or appliances. Both businesses operate at establishments adjacent to the wool-combing plant.

YARN, CLOTH, CARPETING: Three subsidiary companies. Details are as follows—

One subsidiary company with four establishments (all in Victoria) is wholly engaged in manufacture of woollen and worsted yarns and piecegoods. Commission spinning or weaving is not undertaken. The central mill (at Melbourne) makes worsted yarns (English and French systems) for weaving at the central mill into a wide range of worsted cloths, including suitings, frockings, checks, sportswear fabrics, etc., for weaving into mixture fabrics at another mill, and for sale, mainly to knitters. A spinning mill (at a Victorian country town) makes woollen fabric yarns for weaving at a mill (at another Victorian country town, distant from the spinning mill) making, mainly, woollen frockings and tweeds for women's wear coverings, and camelhair slipper cloth. A dyeing and finishing mill (at Melbourne, separate from the central mill), also equipped for waterproofing and mothproofing (but not printing), processes all the company's yarns and piecegoods, and undertakes commission work in all services. (Two associate incorporated companies, subsidiaries of F. & T. of A. Ltd., directly operate with the textile company, one distributing all yarns and piecegoods and the other disposing of all mill wastes.)

One unincorporated business owned and operated by a feltmaking company (see Wool Felt, etc., above), with one establishment (at Melbourne), spins and dyes woollen pile-yarns for use by the next listed company.

One subsidiary company, in which F. & T. of A. Ltd. has a 74 per cent. shareholding and The Carpet Manufacturing Co. Ltd., Kidderminster, U.K., has the remaining shareholding, has one establishment (at Melbourne), and is wholly engaged in weaving of body carpeting in plain, stippled and patterned—Wilton 27 in., 36 in., 40 in., and woollen cord (Brussels); and spool Axminster 27 in. and 36 in. The company is now equipping its plant with spool Axminster 9 ft. looms to make broadloom carpeting and carpet squares. No spinning is carried on, the dyed yarns being supplied by an associate manufacturer (see listing immediately above).

CLOTHING: Three subsidiary companies. Details are as follows—

One subsidiary company with four establishments is wholly engaged as a manufacturer of men's and boys' outerwear. The central factory (at Melbourne) makes men's suits, overcoats, sports coats, and trousers. Three establishments (at country towns, Victoria) make, respectively, boys' and youths' suits and boys' and men's overcoats; toddlers' overcoats, boys' knickers and (at present) blouses for the Armed Services; and boys' knickers.

One subsidiary company with two establishments (at Adelaide) makes multiple-fitting men's suits at one factory, and (usually) boys' and youths' suits at the other, but at present the second factory is engaged on Armed Services' clothing.

One unincorporated business owned and operated by a feltmaking company (see Wool Felt, etc., above), with one establishment (at a Victorian country town), makes men's trousers, at present for the Armed Services.

EMBROIDERY, WOVEN LABELS, QUILTED MATERIALS, QUILTED PRODUCTS, KNITTED INDUSTRIAL FABRICS, BRAIDED PRODUCTS, WOVEN TAPES: Two subsidiary companies. Details are as follows—

One subsidiary company with one establishment (at Melbourne) is wholly engaged in making the following products: Embroideries in the piece on cotton, silk and nylon, including broderie anglaise and needlerun, on own behalf and on commission, and embroidered badges and motifs, made on automatic embroidery machines (the only manufacturer so equipped in Australia); hand-embroidered badges; woven labels and signs; specialised shoe and slipper trimmings; quilted fabrics for garments (cottonwool filled) and slippers (felt filled); quilted upholstering material (leatherette or oilcloth, and cottonwool); knitted fabric for laundry steam-press padding; knitted fabric for dyebags, and fruit-sieving material; dyebags.

One unincorporated business, owned by the company listed immediately above and operated at the same establishment, makes up quilted satin fabrics from the operating company into dressing gowns and bed jackets.

One subsidiary company with one establishment (at Melbourne) is wholly engaged in manufacture of the following products: Braided laces for footwear, corsets, etc.; braided cotton pyjama-cords; braided fancy cords; braided cotton electrical sleeving; cotton braiding over electrical cables; woven cotton tapes for spinning frames and other tapes of heavy construction.

FLOCKS, WADDINGS, PADDINGS, BLANKET INSULATION, QUILTED PRODUCTS: Five subsidiary companies and one associate company. Details are as follows—

One subsidiary company with two establishments (at Melbourne) is wholly concerned at one establishment with breaking down of textile wastes for sale in various blends (including mungo and shoddy) and for incorporation into products made at the other factory, where the broken-down material is garnetted and finished, and made into glazed and unglazed paddings for motor-car bodies, bedding mattresses, hand-bags, quilting, etc. (The second factory also makes needled jute/hair underfelt and insulating felt.) The company also trades in unprocessed fibre and textile wastes.

One subsidiary company with one establishment makes stuffing flock (and operates at the first-named of the two factories of the company listed immediately above).

One subsidiary company with one establishment (at Melbourne) breaks down felting and textile wastes for use by associate companies and for sale.

One subsidiary company with one establishment (at Perth) breaks down textile wastes for trade, manufactures stuffing flock, and repairs sacks and bags.

One unincorporated business owned and operated by a feltmaking company (see Wool Felt, etc., above), with one establishment (at Melbourne), is wholly engaged in making blanket (quilted) insulation for rail, motor-vehicle and air transport equipment (the only manufacturer of such insulation material in Australia), quilted material for sleeping bags, mattress overlays and camp-mattresses, and making up of those products. A folding camp-bed is also made. (Kapok is the filling material used in the blanket insulation, overlays and sleeping bags, and flock waddings in the camp mattresses.)

One associate company, in which F. & T. of A. Ltd. has a 25 per cent. shareholding, a distributing company (not part of the F. & T. group) a 4 per cent. holding, and Robinson & Sons, Chesterfield, U.K., a 71 per cent. holding, has two establishments (at Melbourne). One establishment is wholly concerned with processing of cotton, cotton linters and cotton-mill fibre wastes for the manufacture of medicinal cotton-wool in absorbent and non-absorbent grades, glazed waddings for tailoring, quilted materials and motor upholstery side-trims, and paddings (wadding sewn to hessian) for bedding mattresses and for upholstering of motor-vehicle bodies and furniture. The second establishment is wholly engaged in making up absorbent/soluble sanitary towels from cellulose wadding (which is not made in Australia).

SERVICE: Two subsidiary companies. Details are as follows—

Two unincorporated businesses owned and operated by a wool and wool tops merchanting company (see Wool Tops, above), each with one establishment (at Melbourne), provide services to group companies in Victoria and to outside industry, one in engineering and plant maintenance, the other in electrical installation and servicing.

One unincorporated business owned and operated by a feltmaking company (see Wool Felts, etc., above), with one establishment (at Melbourne), generates and supplies steam to two associated companies nearby, one engaged in dyeing and finishing of yarns and fabrics, the other making Axminster and Wilton carpeting.

NON-MANUFACTURING COMPANIES: Eight incorporated subsidiary companies are active in non-manufacturing activities: One company is a distributor of the worsted yarns and woollen and worsted piecegoods made by the group's yarn and fabric mills; one company is a dealer in mill wastes from the same mills; one company is an import/export agent; one company is a wool trader (now in a small way); three companies are distributors of certain lines of footwear made by the group; and one company is a warehouse for one line of footwear between the manufacturing company and a distributing company, both of which are group companies.

Part Two: Outline of Capacity of Manufacturing Activities

WOOL TEXTILES

SCOURING AND CARBONISING

Capacity in Australia for production of scoured and of carbonised wool is substantially higher than present output. Scoured and carbonised wool is produced both to meet the requirements of Australian manufacturers and for export. A large part of the scouring and/or carbonising of wool for export is done on commission for local dealers and for overseas buyers of Australian wool.

Total Australian production of scoured and of carbonised wool in recent years was—

PRO- DUCTION:	Produced by—		Total
	Fellmongeries	Woolscouring Works (a)	
	mill.lbs.	mill.lbs.	mill.lbs.
1948-49	21.0	141.1	162.1
1949-50	25.3	146.5	171.8
1950-51 (b) ..	20.4	117.8	138.2

(a) Including wool scoured in wool mills.

(b) Preliminary figures.

Figures for 1951-52 show a further decline in output of clean wool, to about 118 million lbs. This decline in production was, at first, caused largely by uncertainties arising from high wool prices, problems of financing stocks, labour, power and fuel difficulties and the exhaustion of stocks of greasy wool accumulated

during the 1939-45 War. The general decline in demand for wool goods, particularly in 1952, is now the major factor restricting output. Lower processing costs in overseas countries are at present also affecting demand on Australian scourers and carbonisers by overseas wool buyers.

The major part of Australian-produced scoured and carbonised wool is exported. Exports over the past few years were—

EXPORTS:	Scoured mill.lbs.	Carbonised mill.lbs.	Total mill.lbs.
1948-49	114.0	24.7	138.7
1949-50	116.5	29.8	146.3
1950-51 (a) ..	89.0	26.1	115.1

(a) Preliminary figures.

Australia's principal market is the United Kingdom, other important markets being the U.S.A. (particularly in 1950-51), Canada, Japan, France, Italy, and Belgium. Most of Australia's exports of wool, however, are in the greasy state. This is because of the preference of buyers, rather than any lack of scouring or carbonising capacity. (In 1948-49 Australia's exports of greasy wool totalled 982 million lbs., in 1949-50, 1,057 million lbs. and in 1950-51, 910 million lbs.)

TOP MAKING

Australian capacity for production of WOOL TOPS is in excess of Australian demand, and considerable quantities have been exported. Both Bradford and French tops are made. Total production of wool tops in Australia in 1948-49 was nearly 36 million lbs., in 1949-50, 30.2 million lbs. and in 1950-51, 30.9 million lbs. Output in 1951-52 declined further to 25.0 million lbs. Capacity would probably be at least 30 per cent. greater than 1950-51 production. (Hair tops are not made in Australia.)

Exports of wool tops from Australia over the last few years were: 1948-49, 4.83 million lbs., 1949-50, 3.95 million lbs., 1950-51, 2.60 million lbs. The principal markets included Belgium, Canada, U.S.A., New Zealand, Hong Kong, Mexico, Greece and the United Kingdom. Immediately after the 1939-45 War, when demand for all types of wool goods was very high, Australian exports of tops were more than double the present level (9.5 million lbs.

in 1945-46, and 9.4 million lbs. in 1946-47), but the return of world competition has caused a severe decline in Australia's exports of tops, which are now less than even the pre-war figure.

Considerable quantities of noils and waste are also exported from Australia (as well as being used here in spinning of woollen yarns). These exports have, in the last few years, greatly exceeded the pre-war exports, which averaged only about 2.5 million lbs. a year in total. Exports of noils and waste in 1948-49, 1949-50 and 1950-51 were—

EXPORTS:	Noils mill.lbs.	Waste mill.lbs.
1948-49	4.5	7.5
1949-50	3.7	9.0
1950-51	2.7	7.3

Principal export markets were the United Kingdom, U.S.A., Canada, Belgium, Denmark and Italy.

YARNS

Australian production of both worsted and woollen yarns is sufficient to meet practically all of Australian requirements, and small quantities are exported. Most of the woollen yarn spun in Australia is spun by the weavers in integrated mills. There are some independent worsted spinners, although the major part of worsted yarn is spun in factories producing knitted garments or piecegoods, woven piecegoods or fingering yarn. Woollen yarn

for carpet making is spun by the carpet manufacturers or their associate companies.

WORSTED YARN, used in the manufacture of woven worsted piecegoods, knitwear and hosiery and hand knitting (fingering) yarn, is manufactured in Australia in sufficient quantities to supply practically all of the present requirements. Australian production of worsted yarn in 1948-49 was 28.3 million lbs. In that year, 12.2 million lbs. were used to make

woven fabrics and 9.8 million lbs. were used by hosiery and knitting mills. In 1949-50, output of worsted yarn fell to about 25.7 million lbs. In that year, usage of worsted yarn for making woven fabrics was about the same, at 12.1 million lbs., and about 8.5 million lbs. were used by hosiery and knitting mills. Production of fingering yarn in 1949-50 was 5.1 million lbs. In 1950-51, production of worsted yarn declined further, to about 24.3 million lbs. In 1951-52, output was even lower at 20.1 million lbs.

The Australian production of WOOLLEN YARN in 1948-49 was 22.4 million lbs., in 1949-50, 23.2 million lbs., and in 1950-51, 21.1 million lbs. In 1951-52, output declined to only 16.8 million lbs. This yarn is used in the manufacture of woven woollen piecegoods, blankets and rugs, etc. There is sufficient

capacity to meet Australian requirements, and small quantities are exported.

Exports of yarns of wool, or containing wool, from Australia totalled 1.12 million lbs. in 1948-49, about 600,000 lbs. in 1949-50 and about 750,000 lbs. in 1950-51.

Imports of wool yarns are, normally, not large, and consist mainly of special types of fancy yarns not made in Australia. Quantities of worsted and woollen yarns imported over the last three years were—

IMPORTS:	Yarns	
	Worsted	Woollen
	'000 lbs.	'000 lbs.
1948-49	252	438
1949-50	263	330
1950-51	54	157

Most of these imports came from the United Kingdom.

WOVEN PIECEGOODS

Present installed capacity in Australia, if operated on two shifts, would be more than sufficient to meet local requirements for woven wool piecegoods, and to permit some export. Since the beginning of 1952, there has been a marked decline in demand for wool goods, and many factories are working well below capacity levels. Considerable quantities of wool piecegoods have been imported, in particular, quantities of fine light-weight fabrics, and some high-priced materials. Australian manufacturers can, however, produce a very wide range of both worsted and woollen cloths.

Australian output of various types of woven wool piecegoods for the past three years was—

PRODUCTION:	1948-49	1949-50	1950-51 (a)
	'000 sq.yds.	'000 sq.yds.	'000 sq.yds.
Woollen cloth and tweed	16,319	13,245	14,794
Worsted cloth	18,074	18,985	19,268
Serge	1,573 (b)	817	861
Flannel for—			
Outerwear	2,937	1,886	1,999
Underwear (c)	1,527	1,659	2,332
Totals	40,430	36,592	39,254
	'000 pairs	'000 pairs	'000 pairs
Blankets	689	896	981
	'000	'000	'000
Rugs	121	122	127

(a) Subject to revision.
(b) Includes output of worsted cloth for Queensland.
(c) Includes flannel for babywear.

In 1951-52, output of woven wool piecegoods was 29.5 million sq. yds. The output of blankets was 642,500 pairs for the same period.

Exports of woven wool piecegoods from Australia in 1948-49 totalled 1.4 million sq. yds.; in 1949-50, 846,836 sq. yds. and in 1950-51, 420,000 sq. yds. Principal markets were New Zealand, Canada and Hong Kong. Exports of blankets were valued at £142,502 in 1948-49 and £83,175 in 1949-50.

Australia's imports of woven wool piecegoods in the last three years were—

IMPORTS:	1948-49	1949-50	1950-51
	'000 sq.yds.	'000 sq.yds.	'000 sq.yds.
Flannels	243	249	185
Worsteds	662	887	1,118
Wholly woollen	5,425	7,134	2,887
Wool mixed with other fibres	173	765	1,457
Other	1,133	1,075	865
Totals	7,636	10,110	6,512

In addition to the items specified above, small quantities of alpacas, lustres, mohairs, Sicilians, imitation camelhair cloth, Italians and tapes-tries were imported. Blankets and blanketing imported were valued at £260,000 in 1948-49, at £695,192 in 1949-50 and at £668,000 in 1950-51. Imports of all wool piecegoods except flannel in 1951-52 were well below 1950-51 levels. The principal source of imported wool goods is the United Kingdom. All imports are now subject to licence—see Appendix II.

COTTON TEXTILE MANUFACTURING

COTTON GINNING

The Queensland Cotton Marketing Board (a State Government body) operates two cotton ginneries in Queensland, the only Australian State where cotton is grown commercially. The Board purchases the seed cotton from growers, gins it, and sells the lint to spinners. It also processes by-products and produces cottonseed oil, meal and cake, and cotton liners.

Australian-grown raw cotton supplies very little of the cotton-spinning industry's requirements. In 1950-51 raw cotton produced in Australia was only about 0.6 million lbs. Pre-war, Australian-grown cotton crops averaged about 6 million lbs. a year.

Since 1913, the cotton-growing industry in Australia has been assisted by the granting of bounties, first by the Queensland Govern-

ment and since 1926 by the Commonwealth Government. Despite Government assistance and encouragement, cotton growing has steadily declined since 1939, in the first instance because of shortage of labour during the war, and more recently because the rising prices of all types of primary products has diverted land to the raising of livestock or growing of other crops.

Imports of raw cotton were 37.2 million lbs. in 1948-49, when the principal sources of supply were India and Brazil; and about 28.4 million lbs. in 1949-50, principally from Brazil and Pakistan. In 1950-51, imports increased considerably, to about 45.2 million lbs. The United States of America was, until 1947, one of the principal suppliers of raw cotton to Australia, but restrictions on dollar expenditure have now reduced imports from the U.S.A. severely.

COTTON YARN

Practically all of the cotton yarn produced in Australia is made by large vertically integrated companies which also weave and/or knit cotton fabrics. Some of these firms spin only for their own requirements, though others sell their surplus yarn to independent non-spinning weavers and knitters or to other industries—cordage, narrow fabrics, sewing thread, etc.

Total production of cotton yarn in 1948-49 was 27.1 million lbs. Production of cotton yarns of various types in 1949-50 and 1950-51 was—

PRODUCTION:	1949-50	1950-51
	mill.lbs.	mill.lbs.
Weaving, including condenser	19.0	24.0
Knitting	6.3	6.3
Cordage, including tyre cord	3.7	5.3
Other	0.7	0.8
Totals	29.7	36.4

Output in the first eight months of 1951-52 was nearly 24 million lbs. of weaving yarn, 4.8 million lbs. of knitting, and 6.2 million lbs. of other yarns (including tyre cord and cordage).

Australian cotton-yarn production is confined to the coarse and medium yarns, in counts less than 50's. There is little demand in Australia at present for yarns of counts between 30's and 50's. Present output of cotton yarn

could be substantially increased if more labour were available, and the industry could supply practically all requirements of coarse-count and medium-count yarns of the present using industries if they were working to capacity. Very little cotton yarn is exported from Australia.

Imports of cotton yarns in 1948-49, 1949-50 and 1950-51 were—

IMPORTS:	1948-49	1949-50	1950-51
	'000 lbs.	'000 lbs.	'000 lbs.
For the manufacture of sewing threads	519.0	647.6	10.7
Counts less than 50's for manufacture of tweeds, etc.	63.2	138.3	83.5
Condenser yarn for manufacture of towels	14.5	63.1	40.6
Mixed with staple fibre	2.0	3.0	70.9
Mercerised	1,384.4	358.8	533.4
Other	9,303.5	4,385.2	9,205.3
Totals	11,286.6	5,596.0	9,944.4

Imports of cotton yarns in the first 11 months of 1951-52 totalled 10.8 million lbs. The United Kingdom supplies between 80 and 90 per cent. of Australian imports of cotton yarns. Normally, imports are confined to fine-count yarns of 50's and finer, which are used by the knitting and hosiery industries and in the manufacture of sewing thread. Such fine-count yarns are not made in Australia at present.

WOVEN COTTON CLOTH

Most of Australia's output of woven cotton cloth is made by a few large, vertically integrated firms (with numerous factories or subsidiaries) which carry out all processes from the raw cotton to the finished cloth, and in some cases the made-up articles.

Manufacturers in Australia have to date, concentrated on the medium- to heavy-weight cloths. Production of woven cotton cloths of various types in the years 1948-49, 1949-50 and 1950-51 was—

PRODUCTION:	1948-49	1949-50	1950-51
	'000sq.yds.	'000sq.yds.	'000sq.yds.
Towelling	138	308	312
Canvas and duck ..	7,142	7,269 (a)	9,359 (a)
Drills, jeans, etc. ..	5,172	6,320	7,100
Cotton tweeds	1,756	2,518	2,447
Denims	90	91	389
Other cotton piece-goods	9,940	11,554	11,845
Totals	24,245	28,060	31,452
	'000 doz.	'000 doz.	'000 doz.
Towels	389	497	518

(a) Includes some flax canvas.

In 1951-52, production was: Towelling (including baby napkins) 1,094,000 sq. yds., canvas and duck 11.2 million sq. yds., drills, etc., 8.7 million sq. yds., tweeds 2.1 million sq. yds., denims 357,000 sq. yds., other piecegoods 11.2 million sq. yds., and towels 501,000 dozen.

In early 1952 there was a considerable fall in activity in the cotton textile industry, although for certain lines, particularly canvas, duck, drills and jeans, production was above 1951 levels. Capacity is sufficient to supply all of Australia's normal requirements of turkish-type towels and towelling, canvas and duck, drills and cotton tweeds. Capacity for production of cotton sheeting and pillow cloth is sufficient to meet approximately 20 per cent. of Australian requirements. (The large firm specialising in manufacture of sheeting and pillow cloth also makes up the cloth into sheets and pillowslips.) Small quantities

of dress cloth are made in Australia, but output meets only a minute fraction of requirements. Cotton furnishing and upholstery fabrics in the heavier weights are made in Australia. (Production is included above in "Other Cotton Piecegoods".) Manufacturers concentrate on the medium-priced to higher-priced jacquard-woven fabrics, as they cannot compete against imports of lower-quality or printed furnishing-fabrics. Tapestry "fillers" are also made. A recently established firm has capacity for weaving cotton ticking.

Imports are still, however, Australia's principal source of supply of cotton piecegoods. The following table sets out imports of cotton piecegoods of various types for the last three years—

IMPORTS:	1948-49	1949-50	1950-51
	£.mill.	£.mill.	£.mill.
Towels and towelling (crash, huckaback, tea towelling, dowlas, forfars, glass cloth, etc.)	1.3	0.5	0.7
Towels and towelling, other	1.2	1.7	0.7
	mill.	mill.	mill.
Calico for bag making ..	1.9	5.0	11.6
Drills, dungarees and jeans	1.5	3.9	5.6
Flannelette	23.0	19.8	16.0
Tapestries .....	.03	0.1	0.1
Cotton piecegoods containing wool or synthetic fibres ..	1.8	2.4	6.1
Canvas and duck	5.9	6.0	8.9
Waterproofed cotton cloth ..	1.0	0.9	1.9
Other—			
Grey, unbleached	32.1	27.0	47.1
White, bleached	51.8	30.8	38.2
Printed	40.5	40.1	37.1
Dyed or coloured woven ..	54.5	59.3	76.6

Imports in 1951-52 were about the same as in 1950-51. The United Kingdom supplies the major part of these imports, other important sources being India (particularly for unbleached cloths), Japan, Czechoslovakia, Italy, the Netherlands, and France. All imports are now subject to licence—see Appendix II.

Exports of cotton piecegoods from Australia in 1948-49 totalled 2.2 million sq. yds. and towels valued at £6,723; in 1949-50, 1.6 million

sq. yds. and towels valued at £10,507; and in 1950-51, 1.8 million sq. yds. and towels valued at £28,701.

COTTON TYRECORD

Production of cotton tyre record is not at present sufficient to meet all Australia's requirements. Output of cotton tyre record in 1950-51 was approximately 5 million lbs., and it is estimated that capacity, based on two-shift operation of existing equipment, would be double this quantity. Imports of cotton tyre record and tyre record fabric in 1950-51 were valued at £1.5

million, and came principally from North America. If Australian capacity for cotton tyre record production were operated fully, and taking into account the proposed manufacture of rayon tyre record (see "Rayon, Silk, Nylon" later), output would be sufficient to meet Australian requirements.

SEWING THREADS

The bulk of Australian production of cotton sewing threads is for industrial uses (the clothing, footwear, bag and sack, etc. manufacturing industries), though some thread is put up for household use. Relatively small quantities of hand-knitting, embroidery and crocheting cottons are also manufactured. (Sewing threads of linen, flax and hemp are discussed in the section relating to Cordage.)

year. In the first eight months of 1951-52, output continued to increase and was 676,300 lbs.

Only very minor quantities of silk or rayon sewing threads are manufactured in Australia.

Total imports of sewing, knitting, crocheting and embroidery threads in 1948-49, 1949-50 and 1950-51 were—

IMPORTS:	1948-49 '000 lbs.	1949-50 '000 lbs.	1950-51 '000 lbs.
Sewing, knitting, crocheting and embroidery silks and silk twists (including rayon silks and twists)	89.2	16.6	24.6
Crochet, knitting, mercerised and embroidery cottons, put up for household purposes	350.9	266.3	258.3
Sewing cotton and threads, not elsewhere included—			
For household use	457.0	217.1	174.1
Other than for household use	2,116.3	1,400.1	1,318.4

Most of the cotton yarn used in the manufacture of sewing threads and of crochet and embroidery cottons is imported (mainly from the United Kingdom). Hand-knitting cottons are made principally from Australian-spun condenser yarn.

In 1949-50, total Australian production of cotton sewing threads of all types was about 684,000 lbs. (compared with 591,265 lbs. in 1948-49), and in 1950-51, over 990,000 lbs. It is estimated that the production of industrial cotton sewing threads is about 750,000 lbs. a

NARROW FABRICS

A number of small firms manufacture COTTON TAPE in Australia, but output is not sufficient to meet local market requirements. Output in 1948-49 was 636 cwt., valued at £63,340; and in 1949-50 395 cwt., valued at £39,438. Imports, the principal source of supply, were valued at £197,817 in 1948-49, at £148,700 in 1949-50, and at £168,901 in 1950-51.

Although some RIBBONS, etc., are made in Australia, imports are, again, the principal source of supply. Imports of ribbons and gal-

loons (of all fibres) in each of 1948-49 and 1949-50 were about 40 million linear yards, about 65 per cent. of which came from the United Kingdom. Most of these were rayon or silk. Some firms recently engaged in the manufacture of ribbons in Australia have been meeting very strong competition from cheaper imports and have not been able to market their products. Actual installed capacity is probably nearly sufficient to meet Australian requirements, but not all of the capacity is being used.

RAYON, SILK AND NYLON MANUFACTURING

YARN

The Australian market is at present entirely dependent on imports for its supplies of rayon, silk and nylon yarns, except for a small quantity of staple-fibre yarns which are spun in Australia, by cotton spinners, from imported staple-fibre. No rayon or nylon filaments or staple-fibres are manufactured in Australia, nor is any raw silk grown.

Some throwing (twisting) of imported rayon, silk and nylon yarns is done, principally by subsidiaries of firms also engaged in weaving or knitting. These throwsters have sufficient capacity to meet all existing requirements for thrown yarn, except for large packages (12 ounce spindles and larger), and, in fact, because of shortages of unthrown yarn, often have idle machinery.

Only small quantities of pure silk yarns are used in Australia, by the knitting and hosiery industries.

The principal users of rayon and nylon yarns are the knitting and hosiery industries. It is estimated that about 8-10 million lbs. a year of rayon yarn and over 1½ million lbs. of nylon yarn is currently being used by the knitting and hosiery industries, and nearly 4 million lbs. of rayon yarn by the rayon-weaving industry. (No pure silk or nylon fabrics are being woven in Australia. Silk for parachutes has been woven here.)

Imports of synthetic-fibre yarns for the years 1948-49, 1949-50, and 1950-51, were—

IMPORTS:	1948-49 '000 lbs.	1949-50 '000 lbs.	1950-51 '000 lbs.
Rayon continuous-filament yarns	12,227	7,099	12,514
Other continuous-filament yarns	59	582	1,645
Staple fibre or spun yarns	105	1,081	4,549
Admixtures of continuous-filament and spun yarns (staple fibre) only	18	160	132
Totals	12,409	8,922	18,840

Small quantities of mixtures of synthetic fibres with wool and cotton are also imported. Imports of silk yarns are very small. Imports of rayon yarns in the first 11 months of 1951-52 totalled 15 million lbs.

Imports of continuous filaments (not twisted) were 2,311 lbs. in 1948-49 and nil in 1949-50, and of staple fibre (not spun), 879,000 lbs. in 1948-49 and 185,000 lbs. in 1949-50. Most of the imports of yarns and fibres came from the United Kingdom.

The manufacture of rayon filament in Australia will be commenced shortly. Courtaulds Ltd., of England, in conjunction with Australian interests, are building a rayon-yarn factory, which is expected to begin operating in 1953, to produce 6 million lbs. of viscose yarn, which will then be twisted into tyre record. By 1954, this factory hopes to be in production

also of about 3 million lbs. a year of acetate yarn for the textile industry. Other plans for the possible manufacture of rayon in Australia contemplate the production of an additional 3 million lbs. of acetate and 6 million lbs. of viscose rayon yarn for the textile industry.

It is estimated that, if planned expansion of the rayon-weaving industry is achieved, the total Australian requirements of rayon yarn will be about 22 million lbs. a year within the next 5 years or so.

(See Chapter 6 for comment on manufacture in Australia of acetate flake, caustic soda, soda ash, sulphuric acid, carbon bi-sulphide and other necessary requirements for rayon-filament manufacture. See Chapter 4 for comment on manufacture of dissolving wood-pulps.)

WOVEN SILK CLOTH. NYLON CLOTH. RAYON CLOTH

No pure silk or nylon fabrics are woven in Australia. Imports of piecegoods of silk, or chiefly of silk, in 1948-49 were 28,100 sq. yds. of milling silk, and 497,800 sq. yds. of other silk; and in 1949-50, 31,400 and 591,200 sq. yds. respectively. Most of these piecegoods came from Japan, with smaller quantities from the United Kingdom, France, Italy and Switzerland. In 1950-51, imports increased further to 65,426 sq. yds. of milling silk and 1.7 million sq. yds. of other silk.

The Australian rayon-weaving industry produces dress materials, linings, underwear fabrics, furnishing fabrics, ribbons and corset cloths. Total production of woven pure-rayon and rayon-mixture fabrics in 1948-49 was 6.6 million sq. yds., and in 1949-50, 7.3 million sq. yds. Production in 1950-51 was about 11.4 million sq. yds. In 1951-52, output was 11.5 million sq. yds. Production has fallen considerably in early 1952.

Manufacturers still plan a considerable expansion of capacity for weaving rayon fabrics within the next few years.

Australia is at present, however, still mainly dependent on imports for its supplies of rayon

piecegoods. Imports in 1948-49, 1949-50 and 1950-51 were—

IMPORTS:	1948-49	1949-50	1950-51
	mill. sq.yds.	mill. sq.yds.	mill. sq.yds.
Tapestries	0.16	0.41	1.10
Synthetic-fibre woollen substitutes	0.09	0.11	0.17
Other fabrics, printed—			
Wholly of spun yarn	11.78	12.27	13.38
Wholly of filament yarn . .	4.58	5.13	5.04
N.E.I., including mixtures of filament and spun yarn or filament or spun yarns mixed with other fibres	1.95	1.46	1.83
Other fabrics, except printed—			
Wholly of spun yarn	19.00	15.57	20.98
Wholly of filament yarn . .	18.65	16.87	20.91
N.E.I., including mixtures of filament and spun yarn or filament or spun yarn mixed with other fibres	8.69	4.83	9.31
Totals	64.90	56.65	72.72

Imports in 1951-52 were slightly higher than in 1950-51. The principal source of these imports was the United Kingdom, except for tapestries which came mainly from Italy. All imports are now subject to licence—see Appendix II.

RAYON TYRECORD

Although no rayon tyre record is at present manufactured in Australia, Courtaulds Ltd. of England, in conjunction with Australian interests, have established a company, Courtaulds (Australia) Ltd., to manufacture 6 million lbs. of viscose rayon tyre record a year. Construction of the factory has begun and it is ex-

pected to start production in 1953. To date, however, all Australia's requirements of rayon tyre record have been imported. Imports over the past three years have averaged a little less than 4½ million lbs. a year, mainly from North America.

FLAX

Flax growing, retting and scutching, spinning, weaving, are, in Australia, four separately owned and conducted operations. The flax is grown by farmers who sell the flax straw to the scutching mills. These mills sell scutched flax and tow to spinners, who also make thread

and rope and cordage, but do not weave; two of the spinners make flax weaving yarn and sell it to the one Australian company weaving flax canvas and firehose. The whole of the scutched flax and tow produced in Australia is used in this country.

DESEEDING, RETTING AND SCUTCHING

These processes are carried out in Government-owned factories in Victoria and South Australia under the direction of the Commonwealth Flax Production Committee and by a co-operatively-operated, State Government-owned, mill in Western Australia. The Flax Production Committee enters into contracts with individual growers in Victoria and South Australia to purchase all their output of flax

straw. The price to be paid is settled by agreement between the growers and the Committee. The W.A. co-operative company operates similarly. The Flax Production Committee was first set up in 1940, and took over the assets and liabilities of a private company which had operated a somewhat similar contract system since 1935; the company was formed by two large cordage manufacturers. At the outbreak

of the 1939-45 War, the United Kingdom was cut off from its main sources of supply of flax, an essential war material, and Australia was asked to grow flax for the United Kingdom. The Commonwealth Government decided that the great expansion involved would have to be carried out under its direct control. Many new scutching mills were set up—in Victoria, South Australia, Western Australia and Tasmania. A number of these mills are now

closed, but the Flax Production Committee still operates eleven mills, and one was sold to the Government of Western Australia.

In 1949-50 a total of 11,000 tons of flax straw was grown in Australia. Total Australian production of line fibre in that year was 1,475 tons, and of tow and pluckings, 1,540 tons. No flax fibre was imported or exported in that year.

YARN AND THREAD

The Australian flax spinners buy their flax fibre from the Flax Production Committee and the Western Australian co-operative company, at prices determined by the Commonwealth. All of the companies make linen thread from their own yarn, and flax twines (for which scutchers' tow is also used). Two of them make flax weaving yarns, for the manufacture of flax canvas and firehose. Most of the yarn made is in counts of 25 lea and less, though yarns as fine as 50 lea have been made. Only the coarser types of flax and linen threads are made here. The companies producing flax yarns and thread in Australia are also manufacturers of cordage, two of them operat-

ing the largest cordage mills in Australia. Figures of Australian production of flax yarns and thread are not available. Australian capacity for production of flax yarns and thread is sufficient to supply all the yarn needed to produce Australia's requirements of cordage, canvas and firehose of flax.

Imports of flax yarns and sewing threads of linen, flax and hemp for the past three years were—

IMPORTS:	Yarns	Thread
	lbs.	lbs.
1948-49	13,872	105,182
1949-50	23,055	71,844
1950-51	9,568	77,644

WEAVING

Davies Coop and Company Ltd. (see also Part One, "Cotton") is the only flax weaving company in Australia at present, and makes flax canvas and firehose.

Total current annual demand for flax canvas is estimated at about 1.5 million sq. yds. The principal users of flax canvas are the Railways Departments of the States and Commonwealth, the Merchant Marine and Royal Australian Navy, and the makers-up of canvas goods—the first two of these are the more important. It is probable that canvas-goods makers would use far greater quantities of flax canvas if it were lower in price, compared with the price of cotton canvas. At present, however, their main usage is of "waterbag" canvas, a mixture of flax and jute yarns.

Output of flax canvas in 1948-49 was about 609,000 sq. yds. The capacity of the weaving plant is about 1,390,000 sq. yds., working one 40-hour shift a week.

Imports of flax canvas in 1948-49 were 1.09 million sq. yds., most of which came from the United Kingdom; in 1949-50, 0.94 million sq. yds.; and in 1950-51, 1.3 million sq. yds.

In 1950, an Act was passed by the Commonwealth Parliament to provide for the payment of a bounty on Australian production of flax

canvas, for two years from July, 1950. According to the provisions of the Act, the rate of bounty varies up to £60 a ton of the weight of scutched fibre used in the manufacture of flax canvas. This bounty was designed to permit the Australian manufacturer to compete in the Australian market against imported flax canvas.

The Australian demand for flax firehose is estimated to be about 500,000 feet a year. This demand is divided roughly into two sections—that for use by fire brigades, and that for installation in buildings. Normally, the latter is by far the largest annual requirement, but the small number of large buildings now being erected has meant that at present this part of requirements is practically confined to replacement needs. The hose required by fire brigades is of the highest quality, a lower quality being sufficient for building installations.

Production of flax firehose in 1948-49 was about 152,000 feet. The capacity of the firehose plant is stated to be 500,000 feet a year, working one shift (40 hours a week). Imports of flax firehose are not separately specified, imports of "Hose, other than rubber" in 1948-49 were 157,325 lbs. and in 1949-50 about 180,800 lbs., imports of hose for fire brigades are included with general equipment for fire brigades.

TEXTILE DYEING, PRINTING AND FINISHING

Australian dyeing, printing and finishing capacity is generally sufficient to meet present demands made by the Australian textile industries for these facilities; in fact considerable activity in textile printing is directed to the processing of cotton and rayon piecegoods imported in the grey.

The major part of bleaching, dyeing and finishing of woven cloths of wool, cotton and rayon is done by the manufacturers in integrated mills. Most of the large hosiery and knitting firms also do their own dyeing and finishing. Most of the smaller textile and knitting firms, however, are dependent on commission dyers and finishers, and in some of these cases capacity is insufficient to meet the demands.

Most of the textile printing is done in Australia by specialist firms, though a couple of them are closely associated with rayon weavers. Little printing of wool textiles is done in Australia, most printing being of woven fabrics of cotton and of rayon, and a small quantity of knitted fabrics and garments. No fine cotton cloths of the printing type are made in Australia, and printing is confined to cottons imported in the grey. Rayon and knitted cloths are the principal Australian-made materials which require printing services. In 1950-51 nearly 6 million yds. of cloth were printed in Australia.

Both screen and roller printing is done in Australia, and, in anticipation of expansion of the rayon-weaving industry, printing capacity

is being increased. It is estimated that printing capacity is about 13.5 million sq. yds. a year on a one-shift basis, 22 million sq. yds. on two shifts and 26.5 million sq. yds. on three shifts. Because of present uncertainties in the textile market, and increasing overseas competition, a large English company has postponed indefinitely its plans to establish a large dyeing, printing and finishing plant in Victoria.

Capacity for shrinkproofing of cotton cloths

CARPETING

Carpet manufacturers in Australia concentrate mainly on the production of body carpeting, the quantity of broadloom and squares produced being small; production of broadloom and squares will increase shortly, as one of the established manufacturers will begin production in addition to carpeting, and another is increasing its capacity. Products include plain, stippled and patterned Wilton; Brussels uncut pile; patterned gripper and spool Axminster (but not chenille Axminster) and wool/hair uncut pile in plain colours with the pile vulcanised into rubber based on hessian.

Australian production of carpeting, in 1949-50, was a little over 1 million sq. yds. Production since has been considerably higher, but the market has fallen off in recent months. The principal materials used in manufacture are wool, cotton and jute yarns. The rubber-based carpeting uses mixed wool and hair fibre, rubber and hessian. All the carpet manufacturers (except the rubber-based carpet manufacturer, where yarns are not used) spin their own wool yarn for the pile, or have it spun by associate companies. Cotton and jute yarns

("Sanforizing") is considerably larger than at present required. Total capacity is thought to be in the region of 2 million yds. a year, exclusive of wool fabrics.

Rotproofing and waterproofing, mainly of canvas, is done by both canvas weavers and firms engaged in making-up of canvas goods. The installed capacity is sufficient to meet the demands on the industry.

are bought from other (Australian) firms. Australia does not produce sufficiently coarse wool for carpet yarns, and considerable quantities of coarse greasy-wool are imported, principally from New Zealand, mainly for the carpet industry. Imports in 1948-49 were about 6 million lbs.; in 1949-50, 4.9 million lbs.; and in 1950-51, 2.1 million lbs.

Imports of carpets and carpeting, and floor rugs of all kinds except coir, grass and similar types, in 1949-50 totalled 6.6 million sq. yds., and in 1950-51, 7.4 million sq. yds. In addition, in 1949-50 imports of carriage mats of textile materials, except coir, were valued at £168,206; and in 1950-51 at £33,967.

Although there has been a decline in the market in late 1951-52 and heavy stocks have accumulated, the imposition of import restrictions should encourage local production once stocks are exhausted.

The possibilities of extension of the Australian carpet industry have been considered by some manufacturers of carpets in Australia and overseas.

WOOL FELTS AND HARD HAIR FELTS (excluding Needled Felts)

Australian firms make a variety of WOOL FELTS, the principal types being flooring, slipper, furnishing, millinery and engineering felts. In general, production of these types of felt is sufficient to supply Australian requirements. Total output of wool felt in 1948-49 was 8.5 million sq. yds., and in 1949-50, 7.3 million sq. yds. Felt & Textiles of Australia Ltd. is the principal producer of flooring and slipper felts, which are made in a wide range of colours. Flooring felts are made in plain colours, mottled and printed.

Imports of wool felt into Australia are not large, and in 1948-49 were only 1,408 sq. yds. of slipper upper felt and 227,717 sq. yds. of other wool felts. Felts for asbestos-cement sheetmaking machines valued at £37,790 were also imported. In 1949-50 imports were 733 sq.

yds. of slipper upper felt, 164,234 sq. yds. of other wool felt, and felt for asbestos-cement sheetmaking machines valued at £48,533.

WOVEN FELTS for papermaking and stereotyping are not made in Australia. Felt & Textiles of Australia Ltd. has a licensing agreement with a United Kingdom firm for manufacture of paper-making felts, but manufacturing plans are in abeyance at present. This firm has made stereotyping felts, but has discontinued that activity.

No statistics are available on the production, import or export of HARD HAIR FELTS. It may be said that local production is fairly adequate to meet the Australian demand. Felt & Textiles of Australia Ltd. is the largest manufacturer, and also engages in stuff cutting of hard hair felt for footwear manufacture.

CROCHETED FABRICS

There are several companies, some of which are physically unassociated with the textile industry proper, engaged in production of CROCHETED OPEN-MESH PIECEGOODS AND PRODUCTS in Australia. The making of laundry-bag netting and making-up of the bags therefrom, probably forms the major part of the trade, but a portion of the requirements of dishcloths, sweatbags, pyjama cords, open-mesh cot shawls, blankets and quilts, is made within these factories. Most of the raw material used

is cotton yarn; however, some wool and some rayon yarns are also used. The production of curtain netting in Australia is negligible, the requirements being imported. Value of imports of curtains (and blinds) in 1948-49 was £28,336, and in 1949-50 £35,500, and sponge-cloths, sweatbags and dorset cloths (including materials in the piece) amounted in value to £5,233 and £17,500, respectively, for the same periods.

ELASTIC AND ELASTIC FABRICS

Australian factories make woven and braided narrow elastics, knitted and woven corset elastic-fabrics, including leno and satin fabrics (single and two-way stretch) and covered rubber thread for use in making elastic fabrics. Some of these manufacturers also make rigid fabrics, tapes and braids, corset and shoe laces, etc. (One firm also makes its own machinery for elastic manufacture.)

No figures are available for total Australian output of elastic or elastic fabrics. In 1949 one company (by far the largest narrow-elastic manufacturer in Australia) made 37.87 million yds. of woven and braided narrow fabrics (99 per cent. of which were elastic). This company is expanding its capacity, and will very shortly have sufficient capacity to supply all of Australia's requirements of woven and braided elastics up to 2 inches in width, with the exception of men's and boys' fancy brace and garter elastics, which are not made in Australia at present. There has been considerable expansion in the last few years in the elastic industry,

and further expansion is planned. One firm making elastic fabrics is a subsidiary of a large American manufacturer.

Although imports of elastics and elastic fabrics, other than knitted, in 1948-49 were considerable, they are not a true indication of deficiencies of Australian production as not all factories were then working to full capacity. Imports in 1948-49 of knitted elastics, in tubular form, were a little over 7,000 sq. yds. (valued at about £7,000); of elastics under one inch in width, 13.4 million lin. yds. (valued at £104,000); and of all other elastics or elastic fabrics, 441,000 sq. yds. (valued at £291,460). In 1949-50, imports of elastics under 1 inch in width fell to about 8 million lin. yds., and of elastic over 1 inch wide (but not including knitted) to about 340,000 sq. yds. The principal source of imports was the United Kingdom.

In 1948-49 exports from Australia of all types of elastic were valued at £4,400. In 1949-50 exports increased in value to £20,824. The principal market was New Zealand.

BRAIDS, EMBROIDERIES, LACE, MISCELLANEOUS TEXTILES

No production figures are available for output of BRAIDS, EMBROIDERIES, FRINGINGS, FRILLINGS, BINDINGS, etc., in Australia. Imports of some items in 1948-49 and 1949-50 were substantial in value—

IMPORTS:	1948-49 £	1949-50 £
Braids, fringes and edgings, textile (not for attire)	45,957	32,423
Badges, badged hat and cap fronts, looping for boots and shoes, labels and hangers for all purposes, slipper, shoe and blazer bindings	19,262	20,059
Cotton featherstitch braids, pipings	8,452	15,996
Braids, fringes, frillings, rufflings, ruchings, pleatings, belting for apparel (not cut into lengths for apparel), etc.	230,042	182,474
Tinsel fabrics and materials, threads, cloth, ribbons, belting, etc.	75,503	70,720

The manufacture of LACE in Australia is confined to embroidered lace-like fabrics and edgings. Most requirements of lace are obtained from overseas; imports of lace for attire, lace flouncings, millinery and dress nets and veilings in 1948-49 were valued at over £1 million, and in 1949-50 at over £1.5 million.

BUNTING is not made in Australia. Imports in 1948-49 amounted to 273,774 sq. yds., and to 13,757 sq. yds. in 1949-50. FLAGS and BANNERS were also imported, in 1948-49 to the value of £31,869, and in 1949-50 to £2,436. (See Canvas Goods, etc. — Chapter 17.)

There were 675 articles of WIGS, TRANSFORMATIONS and FRINGES imported in 1948-49 and 435 in 1949-50; and other articles of imitation hair, including HAIR NETS, to the value of £57,045 in 1948-49 and £109,000 in 1949-50.

HAIR PREPARATION

The preparation of bovine body hair consists of cleaning and drying in preparation for further treatment by manufacturers of hard hair felts and needled jute/hair underfelt. The supply of prepared hair available is not sufficient to meet Australian requirements, and considerable quantities are imported. The quantity of hair used in needled underfelt varies considerably with the price. The present shortage of bovine body hair is mainly the result of the shortage of labour in tanneries treating the hides. Instead of pulling the hair from the hides, it is now more often removed with sodium sulphide, which makes it unusable. The one Australian firm engaged in hair preparation, a subsidiary of Felt & Textiles of Australia Ltd., sells all its output to its parent company and other subsidiaries of that company for production of hard hair and needled

felts. Other manufacturers of hair felts import their requirements of treated hair.

Australian imports of animal hair in 1949-50 and 1950-51 were—

IMPORTS:	1949-50 cwt.	1950-51(a) cwt.
Fine animal hair	7,887	119
Animal hair, n.e.i.	4,207	13,927
Totals	12,094	14,046

(a) Preliminary figures from Customs clearances.

Most of the imported animal hair came from the United Kingdom and India.

Exports of animal hair (of all types) from Australia totalled about 1,514 cwt. in 1949-50 and 2,062 cwt. in 1950-51, and went mainly to the United States of America, the United Kingdom and Belgium.

HAIR WEAVING

Hair yarns are not spun in Australia. Imports in 1948-49 of fine hair yarns were 180,000 lbs., and of coarse hair yarns, 517,000 lbs. In

1949-50, imports declined considerably, to about 97,000 lbs. of fine and 3,600 lbs. of coarse hair yarns; but rose again in 1950-51 to 153,604 lbs.

of fine and 17,059 lbs. of coarse hair yarns. Most of these imports are obtained from the United Kingdom. Manufacturers consider that the Australian market will not support an economic production unit.

Small quantities of hair cloth for interlining apparel are woven in Australia, from imported hair yarns mixed with a special Australian-made coarse wool yarn. These manufacturers

COIR WEAVING

Imported coir yarn is used in the manufacture of coir mats and matting, including cricket mats and matting. Coir weaving yarn is not made in Australia. Imports were 1.38 million lbs. in 1948-49, about 888,000 lbs. in 1949-50 and 1.6 million lbs. in 1950-51.

Practically all coir weaving in Australia is done in penal establishments and institutions for the care of blind persons. The matting is

concentrate on high-grade linings, as they cannot compete against imported lower-quality linings. No Australian production figures are available. Imports of hair cloth for interlining apparel in 1948-49 were a little over 1 million sq. yds.; in 1949-50, 475,159 sq. yds. and in 1950-51, 744,620 sq. yds. Practically all of these imports came from the United Kingdom.

made on both machine and hand (frame) looms. Production figures are not available, but a large part of Australian requirements is met. Imports of coir mats and matting, including cricket mats and matting, were valued at £187,126 in 1948-49; at £262,856 in 1949-50, and at £298,845 in 1950-51. Most of the imports of coir yarn and matting came from India.

JUTE WEAVING

The weaving of 85-inch wide jute piecegoods was recently commenced by a small textile mill in Victoria. So far, production has been more or less on an experimental scale, and normally could not compete against imported jute. However, jute piecegoods are scarce at present, and

the firm is selling all its output for use in the manufacture of carpeting. Apart from the small quantity produced by this firm, all of Australia's requirements are imported. Imports of jute piecegoods in 1949-50 were 33.5 million square yards, valued at £1.8 million.

CORDAGE

The production of ROPE, CORDS, TWINES, SEWING THREADS, etc., in Australia is almost sufficient to meet the market requirements, and capacity is in excess of present production.

The cordage is made from hemp, sisal, flax, coir, jute, cotton and similar fibres, most of which, except flax, are imported.

With the exception of cotton yarn (which is obtained from Australian cotton spinners) practically all of the yarns used in the manufacture of cordage are spun by the same firms as make the cordage, and output meets most of the Australian requirements. (For cotton spinning see "Cotton", earlier this Part.) Some cordage manufacturers also make SEWING THREAD of flax, linen, hemp, etc. Production figures for yarns and threads are not available. There is some idle capacity in the industry. Imports of hemp yarns, were 386 lbs. in 1948-49, 1,253 lbs. in 1949-50, and only 20 lbs. in 1950-51. (Flax is dealt with in a separate section; see earlier this Part.) Imports of sewing threads of linen, flax or hemp totalled 105,182 lbs. in 1948-49, 71,844 lbs. in 1949-50 and 77,644 lbs. in 1950-51.

Australian production of rope, cords, twines, etc., in 1948-49 and 1949-50 was—

PRODUCTION:	1948-49	1949-50
	'000 cwt.	'000 cwt.
Sash and other cords	20.2	13.3
Ropes and cables	117.2	115.7
Twine—		
Binder	32.9	33.2
Shop	29.9	23.1
Other	19.5	26.9

Production of fishing line was valued at £156,351 in 1948-49 and at £139,495 in 1949-50.

In 1948-49, 580 cwt. of cotton twines and 1,061 cwt. of other cordage, etc., were imported; in 1949-50, 167 cwt. and 437 cwt. respectively; and in 1950-51, 121 cwt. and 4,663 cwt. respectively. The principal source of these imports was the United Kingdom.

Australia exported, in 1948-49, 290 cwt. of reaper and binder twines and yarns, and 8,552 cwt. of other twines, cords and rope, etc. In 1949-50, these exports amounted to 285 cwt. and 9,144 cwt. respectively, and in 1950-51, 430 cwt. and 8,366 cwt. respectively. These exports went mainly to various Pacific Islands and New Zealand.

Part Three: Basic Statistics

COMPARATIVE STATISTICS, 1938-39/1949-50

NUMBER OF ESTABLISHMENTS AT 1938-39 AND 1949-50

NUMBER OF EMPLOYEES AT 1938-39, 1949-50, JUNE 1950, SEPTEMBER 1951

Activity (Statistical Sub-classes used by Commonwealth Statistician, 1949-50)	Establishments		Employees			
	1938-39	1949-50	1938-39	1949-50	June 1950 (a)	Sept. 1951 (a)
Wool—Carding, Spinning and Weaving (b)	no. (c) 90	no. 168	no. (c) 19,608	no. 24,354	no. 23,373	no. 23,586
Cotton Ginning	} (c) 35	2	} (c) 3,650	29	} (f) 8,935	(f) 9,875
Cotton Spinning and Weaving (d)		93		8,377		
Rayon, Nylon and Other Synthetic Fibres (g)		14		1,820		
Silk, Natural (h)	(j) 6	6	(j) 524	399	1,622	(j) 2,006
Flax Mills (k)	(l)	15	(l)	611	299	669
Rope and Cordage		26		2,217	629	2,670
Other (of Class VI) (m)	18	155	1,695	3,851	2,381	3,415
Totals (n)	29	178	602	41,649	3,166	42,221

STATISTICAL SUMMARY, 1949-50

EMPLOYMENT, MALE AND FEMALE

SALARIES AND WAGES PAID, IN TOTAL AND PER PERSON ENGAGED

VALUE OF PRODUCTION

VALUE OF MATERIALS, POWER, FUEL, REPAIRS, etc.

VALUE OF OUTPUT

See Explanations,
Appendix IV

Activity (Statistical Sub-classes used by Commonwealth Statistician, 1949-50)	Employment			Salaries and Wages Paid		Value of Pro- duction	Value of Materials, Fuel, etc. Used	Value of Output
	Males	Females	Persons	Total	Per Person Engaged			
Wool-Carding, Spinning and Weaving (b)	no. 12,411	no. 11,943	no. 24,354	£'000 9,404	£ 386	£'000 16,426	£'000 33,573	£'000 40,999
Cotton Ginning	26	3	29	10	345	2	28	30
Cotton Spinning and Weaving (d)	4,164	4,213	8,377	3,306	395	5,991	10,197	16,188
Rayon, Nylon and other Synthetic Fibres (g)	1,250	570	1,820	812	440	1,380	1,389	2,769
Silk, Natural (h)	134	256	390	133	341	239	280	519
Flax Mills (k)	543	68	611	266	436	200	621	911
Rope and Cordage	1,406	811	2,217	915	413	1,588	2,524	4,112
Other (of Class VI) (m)	2,201	1,650	3,851	1,536	399	2,994	5,428	8,422
Totals (n)	22,135	19,514	41,649	16,382	393	28,910	54,040	82,950

Explanatory Footnotes to Both Tables

- (a) These employment figures are taken from monthly payroll-tax returns and differ slightly from the other employment figures, which are supplied on annual factory returns.
- (b) Also includes combing (topmaking), where it is the sole or major activity and where it is carried on as part of integrated wool-textiles manufacture; includes scouring, and dyeing and finishing, where such are carried on as parts of integrated wool-textiles manufacture; includes spinning sections of knitting mills and carpet mills integrated with spinning, when the spinning activity is large enough to require separate classification. Does not include knitting.
- (c) At 1938-39 the sub-class was entitled "Wool, Worsted and Shoddy (including Woolscouring)", but the official published statistics explain that the establishments in New South Wales, Queensland and Western Australia classifiable as woolscouring establishments were included in the sub-class then entitled "Fellmongery"; see also Part Three, Chapter 14, "Leathers, Woolled Skins, and Products". The sub-class "Wool, etc." included woolscouring establishments in Victoria, South Australia and Tasmania, and also establishments in South Australia classifiable as a fellmongery.
- (d) Also includes carding; doubling; sewing threads; and spinning sections of knitting mills and candlewick-chenille plants integrated with spinning, where the spinning activity is large enough to require separate classification. Includes dyeing, finishing, printing, proofing, etc., only where such are carried on as lesser activities within integrated cotton mills. Does not include knitting.
- (e) At 1938-39 the present sub-classes "Cotton Ginning" and "Cotton Spinning and Weaving" made up one sub-class entitled "Cotton".
- (f) Separate figures for each sub-class were not published.
- (g) Includes twisting and preparing of synthetic fibres, and the weaving and finishing (integrated with weaving) of rayon piecegoods. Does not include knitting of synthetic yarns.
- (h) Originally concerned only with twisting and preparing of natural silk yarns, and silk weaving, and later with "artificial-silk" also. Does not include knitting. The sub-class should be read in conjunction with the preceding sub-class "Rayon, Nylon and Other Synthetic Fibres".

- (j) At 1938-39 there was very little weaving of rayon in Australia, and the twisting, etc., of rayon and other synthetic yarns as an activity was included in the then sub-class "Silk, Natural and Artificial".
- (k) Retting and scutching mills only.
- (l) Apparently not collected.
- (m) The sub-class "Other" is one of miscellaneous activities not elsewhere included within the Commonwealth Statistician's Class VI, "Textiles and Textile Goods (not Dress)". The sub-class includes carpeting and carpets; felt and felt products; crocheted fabrics and laundry bags; textiles dyeing, printing, finishing, shrink and rot proofing; cords and braids; hair weaving; coir weaving; plastics coating of fabrics; dressing of fabrics, by filling, impregnating, calendering, pigmenting, etc.; candlewick-chenille tufting and associated making-up of candlewick products and garments; surgical dressings and medical plasters; waddings and paddings; textile-wastes treatment; netting and nets for sports, fishing and industrial use; wig making; miscellaneous products such as felt badges and pennants, dusters, woolled sheepskin products (including powder puffs, mats), artificial hair, dolls' wigs, movie-screens, parachutes. Many of these items are discussed in Chapter 17, "Products of Textiles and/or Wastes, Cordage, Hair, Felt, Not Elsewhere Included".
- (n) Consideration and comparison of totals must take into account the effects stated in footnotes explaining the composition of certain sub-classes and figure units.

Chapter 16:

CLOTHING

MANCHESTER

NAPERY

FOOTWEAR

Part One: Structure of Established Manufacturing Activities

THE manufacture of clothing, manchester, napery and footwear is established in Australia as listed below, the extent of association of activities being shown by bracketing and annotation. The listing is intended to be indicative, but not necessarily fully inclusive.

THE CLOTHING AND MANCHESTER AND NAPERY INDUSTRIES

TAILORED AND READY-MADE CLOTHING—

Men's tailored wear (made-to-order): Lounge, dinner, dress, leisure; officers' Service uniforms; ceremonial; topcoats; academic hoods and gowns, hunting coats and breeches. Women's tailored wear (made-to-order): Suits, topcoats, skirts, jackets.

Ready-made clothing, including men's and women's suits; children's outerwear; sports clothing, overcoats; trousers, slacks; skirts; dressing gowns; work clothes; ladies' cloaks; chenille garments; sun suits; ski and snow suits, robes; hunting coats, vests; lumber jackets; wind-cheaters (fabric, not knitted); suede garments; riding clothes; raincoats; uniforms; Services' uniforms; spats; leather garments.

Government-owned (Commonwealth) clothing factory which makes a wide range of Services apparel (but which has capacity sufficient to meet only portion of Services requirements when rapid expansion of demand occurs). Some of the companies have branch factories, and a few companies make clothes for their own retail stores. Of the total establishments in this group, in 1948-49, 928 each employed up to 10 persons, 403 each from 11 to 20 persons, 381 each from 21 to 50 persons, 117 each from 51 to 100 persons, and 45 each more than 100 persons. The latter 45 companies collectively employed 7,290 out of a total of 38,500 persons engaged in the tailored and ready-made clothing section of the industry.

DRESSES AND MANTLES—

Including blouses; dresses (made-to-order); capes; children's frocks; infants' wear; lace clothing; play suits; robes; smocks; sports clothing; sun suits; theatrical costumes; uniforms for females; belts of dress fabric and plastic; button covering and button-holing.

clientele, and the others are small "ready-made" factories. Of the remainder of the establishments 480 each employed from 11 to 50 persons, and 58 each more than 51 persons; only fourteen factories each employed more than 100 persons, in aggregate 2,564 persons out of 18,787 engaged in dressmaking, etc. Many of the factories make a range of products; others specialise in one or a few items of clothing shown at the left; some other manufacturers produce only one quality of garment, and other firms make a range of qualities. Some of the production of mantles is manufactured in workshops owned by retail emporiums, and a few companies own retail shops and make frocks exclusively for that trade. A few companies have two or more decentralised factories.

WATERPROOF AND OILSKIN CLOTHING—

Including rain-coats of rubberised, oiled or chemically-proofed fabrics; sports jackets and trousers; hats; industrial and seamen's garments.

Making up of waterproof sheeting.

coaters and impregnators of fabric do not make up clothing.) A few vigorous companies dominate the industry. Of the total establishments in this group, in 1948-49, 6 each employed up to 10 persons, 18 each from 11 to 50 persons, 4 each 51 to 100 persons, and 2 each more than 100 persons.

FUR GARMENTS (including Mouton and Curly-lamb)—

Fur dressing and dyeing. (See Chapter 14, "Fellmongering Leathers and Leather Products", for Mouton and Curly-lamb skin dressing.)

Garments and accessories: Coats, collars, capes, caps, gloves, trimmings, muffs.

In 1949-50 there were 1,902 establishments compared with 1,874 in 1948-49 wholly or mainly engaged in making tailored or ready-made clothing in Australia. Many tailors specialise in men's wear, some make men's and women's wear, a few others specialise in women's wear. Within the ready-made group of establishments are enterprises concerned with producing a very wide range of clothing; some make a limited range and sometimes produce clothes for one sex only; some are specialists in making one or a few items of apparel; some specialise in making only one item in multiple sizes; some are commission makers, particularly for wholesale warehouses; there is one

In 1949-50 there were 1,109 establishments compared with 1,059 in 1948-49 wholly or mainly engaged in dressmaking and mantle manufacturing in Australia. Of those latter 1,059 establishments 522 (49 per cent.) were small enterprises, each employing up to ten persons; many of these small firms are makers of dresses for a private "made-to-measure" factories. Of the remainder of the establishments 522 (49 per cent.) were small enterprises, each employing up to ten persons; many of these small firms are makers of dresses for a private "made-to-measure"

In 1949-50 there were 35 establishments compared with 30 in 1948-49 wholly or mainly engaged in waterproofed clothing manufacture in Australia. About six companies proof cloth by rubber coating and also make up garments; three of those companies are also rubber-products manufacturers. (The plastics

In 1949-50 there were 129 establishments compared with 135 in 1948-49 wholly or mainly engaged in this industry. A few companies dress and dye furs (and skins) only, and some of the dyers/dressers also make up garments; the majority, however, are only makers of fur garments and accessories. The industry comprises many small enterprises; in 1948-49, 111 of the

establishments each employed up to 10 persons, 16 each from 11 to 20 persons, 7 each from 21 to 50 persons, and 1 employed more than 50 persons.

SHIRTS, COLLARS, UNDERCLOTHING (NOT KNITTED), MANCHESTER—

Garments: Shirts and collars, pyjamas, handkerchiefs, neckties, scarves, and other whitework.

Sheets, pillowcases, tablecloths and napkins, baby squares and other manchester goods.

Embroidery, needlework, lacework.

In 1949-50 there were 397 establishments compared with 410 in 1948-49 wholly or mainly engaged in whitework manufacturing in Australia. More than 300 of these factories are situated at Sydney or Melbourne. Most shirt companies are specialist manufacturers, but some are concerned with production of allied products; one of the largest shirt manufacturers in Australia is also a large producer of

handkerchiefs. A few firms specialise in fusing of collars. One company (see Chapter 15, "Textiles, Felting, Cordage") spins, weaves and makes-up cotton fabric into sheets and pillowcases. A section of manufacturers within this group are "commission makers-up" and are fully employed by importing warehouses and/or wholesalers who supply materials; the greater part of these materials are imported. A small number of firms produce embroidered work; some of these are specialists, others are concerned with other types of work of a specialised nature, but only one company is equipped to produce machine-made embroidery in the piece. Of the total number of establishments in this group in 1948-49, 109 each employed up to 10 persons, 237 each from 11 to 50 persons, 44 each from 51 to 100 persons; 20 establishments each employed more than 101 persons and an aggregate of 3,708 out of an industry employment of 12,875.

KNITTED GOODS AND HOSIERY—

Hosiery: Women's, maids' and girls', men's and boys', children's.

Underwear: Vests, bloomers, pantettes, scanties, singlets, underpants, shirts, spencers.

Outerwear: Jumpers, pullovers, cardigans, sweaters, twin sets, costumes, dresses, blouses.

Nightwear: Nightdresses, bed jackets, dressing robes, negligees, pyjamas.

Beachwear: Bathing suits, beach robes.

Miscellaneous: Pram and cot (knitted) blankets, bonnets, gloves, mittens, neck ties, scarves, shawls, booties, fabric.

Making-up of garments, unassociated with knitting.

In 1949-50 there were 496 establishments compared with 465 in 1948-49 wholly or mainly engaged in production of knitted goods in Australia. The mills range from very small to very large establishments. Many mills, particularly the smaller ones, confine their activities to one type of production, while others manufacture two or more classes of knitted goods. About ten of the largest knitters of wool goods spin most or all of their worsted-yarn requirements (see Chapter 15, "Textiles, Felting, Cordage"), and about four large knitters of cotton goods also spin their cotton-yarn requirements (see Chapter 15, "Textiles, Felting, Cordage"). The mills mainly produce apparel from fabric knitted in their own establishments, but some knitters dispose of fabric in the form of piece-goods to makers-up. Of the total establish-

ments in this group, in 1948-49 (and excluding spinning sections), 156 each employed up to 10 persons, 97 each from 11 to 20 persons, 115 each from 21 to 50 persons, 52 each from 51 to 100 persons, 26 each from 101 to 200 persons, 6 each from 201 to 300 persons, 5 each from 301 to 400 persons, 8 each over 400 persons. The 45 establishments each employing more than 100 persons employed in aggregate 11,394 persons out of an industry total of 21,172 persons.

FOUNDATION GARMENTS—

Corsets, including maternity; corselettes; dance-belts; girdles; "roll-ons"; suspender belts; brassieres.

Made-to-measure corsetry, including surgical corsetry.

In 1949-50 there were 59 establishments compared with 61 in 1948-49 wholly or mainly engaged in manufacturing foundation garments in Australia. A small number of large companies dominate the industry. The production from larger factories is mainly mass produced, but

some made-to-order, and sometimes surgical corsetry is also made in the large factories. A few smaller companies are engaged only upon made-to-measure and surgical corsetry. Part of the brassieres production is from factories which do not make corsets. Of the total number of 1948-49 establishments in this group, 25 each employed up to 10 persons, 20 each from 11 to 50 persons, 6 each from 51 to 100 persons; 10 establishments each employed more than 100 persons and an aggregate of 2,065 out of an industry employment of 3,081.

HANDKERCHIEFS, TIES, SCARVES—

Handkerchiefs: Nine major companies making up from imported materials. Some production also comes from whitework factories; one company is also a large producer of shirts.

Neckties: Many small and a few large companies making-up from mostly imported materials. (Some woollen tie-fabrics and ties are produced in Australia by knitters.)

Scarves: A small-scale activity linked with silk-screen printing, knitting and making-up sections of the clothing industry.

Braces, hose suspenders: About 20 manufacturers, most of which are specialists. (A big proportion of elastic webbing used is imported.)

In 1949-50 there were 66 establishments compared with 74 in 1948-49 wholly or mainly engaged within this group. Two large companies, each of which employed more than 100 persons (and in aggregate 405 persons out of a group total of 1,565 persons) dominate the group. Fifty per cent. of the establishments each employed between 11 and 50 persons, and 44 per cent. each employed not more than 10 persons.

HATS, CAPS AND MILLINERY—

Hats, felt, of fur and/or wool: Felting.
 Caps, men's and boys': children's headwear.
 Sports hats and caps (cloth); hats and caps (uniform).
 Hats, silk and opera. Helmets.
 Hats, panama and straw (not plaiting).

In 1949-50 there were 256 (204 as milliners and about 52 as hat or cap makers) establishments compared with 262 in 1948-49 wholly or mainly engaged. Six large felt-hat companies, which in aggregate employed in 1948-49 1,312 persons out of 2,210 persons engaged mainly in making non-millinery hats and caps, dominate the felt-hat trade, and four other smaller companies contribute to a lesser degree to Australia's total production of felt hats. About 55 per cent. of the cap-makers

each employed from 11 to 50 persons, and about 25 per cent. each employed not more than 10 persons. Of the 211 millinery establishments in 1948-49, 51 each employed up to 4 persons, 59 each from 5 to 10 persons, 89 each from 11 to 50 persons, 10 each from 51 to 100 persons, 2 each more than 100 persons; the twelve largest establishments in aggregate employed 948 persons out of the industry total of 3,448 persons.

ARTIFICIAL FLOWERS: In 1949-50 there were 18 establishments wholly or mainly engaged in this activity. In 1948-49 one of the companies employed 130 persons, another company 55 persons, five other companies each employed between 21 and 50 persons.

GLOVES (NOT KNITTED)—

Gloves and mittens of cloth and fabric.
 Gloves, dress, of leather.
 Gloves, industrial, cloths and leather.

In 1949-50 there were 56 establishments compared with 57 in 1948-49 which were mainly or wholly concerned with glove making. Fashion gloves are usually made in factories unassociated with those producing industrial gloves, but in one or two instances those activities are combined. Of the 1948-49 glove makers

in Australia, 23 each employed up to 10 persons, 30 each from 11 to 50 persons; 1 employed 66 persons; 3 establishments each employed more than 100 persons and in aggregate 326 persons of an industry total of 1,247 persons.

DRY-CLEANING, PRESSING, DYEING, OF CLOTHING, UNDERCLOTHING AND PIECE GOODS—

Dry-cleaning and Pressing.
 Dyeing.

In 1949-50 there were 656 establishments compared with 600 in 1948-49 wholly or mainly engaged in either dry-cleaning and pressing or dyeing (not including textile dyeing). The greater number are dry-cleaners and pressers only, often also acting as a depot for a central dyer, but a minority of dry-cleaners and pressers also dye as an incidental activity; the greater part of dyeing is done by a few larger dyers serving each of the capital-city metropolitan areas (some of the dyers also do dyeing for the textiles industry). Some cleaning establishments also renovate and repair clothing and household napery, and a greater quantity of tailors' and factory-made clothing is being pressed by cleaning and pressing establishments. Some cleaners and pressers have extensive depot and pick-up systems. In 1948-49, 363 establishments each employed up to 10 persons, 202 each from 11 to 50 persons, 27 each from 51 to 100 persons; 8 establishments each employed over 100 persons and, in aggregate, 1,162 persons out of an industry total of 9,141.

ACTIVITIES concerned with clothing, manchester and napery manufacture, renovation and repair, and not covered previously in this part, are listed below, with, where known, the number (or an approximation) of manufacturers engaged in each activity—

Button Covering: About five establishments operating partly or mainly as button coverers. There are many dressmaking and mantle manufacturers engaged in covering their own buttons other than those listed as specialists. Most of these specialist firms are small.

Shoulder Pads: About ten establishments are wholly or mainly concerned with production of shoulder pads. Shoulder pads are also made by some garment factories.

Collar Fusing: About ten establishments engaged as specialists.

Repair of Clothing and Whitework, including Invisible Mending and Weaving: About fifty repairers engaged as specialists (only a few of which would be considered as establishments, that is, factories, for statistical purposes).

Laundries: There are about 350 laundries established in Australia. Some of these are small suburban and country firms; some are "self-service" establishments using domestic-type fully-automatic washing machines and centrifugal dryers (the number of such establishments, usually located in central shopping areas, increased considerably from about 1948 onwards); some are large companies having a number of depots and in a few instances branch establishments, while there are also some large-scale laundries operated by convents. Some laundries are also, incidentally, dry-cleaners and pressers, and a few also dye.

THE FOOTWEAR INDUSTRY

BOOTS AND SHOES: In 1949-50 there were 495 establishments compared with 529 in 1948-49 wholly or mainly engaged in manufacture of footwear other than of rubber-soled footwear with canvas or rubber uppers. (See Chapter 8, "Rubber Products".) Sixty-eight are large companies by Australian standards, each employing more than 100 persons, and in aggregate (in 1948-49) employed 12,047 persons out of an industry total of 23,224. Of the remainder of establishments in 1948-49, 180 each employed up to 10 persons, 218 each from 11 to 50 persons, and 63 each from 51 to 100 persons.

Men's footwear.	}	Each of these activities is carried out separately in Australia, with specialisation on certain types of footwear within each activity. A few companies carry on all the activities, but a number of companies are engaged in two or three of the activities. The greater part of slipper-production is by specialist manufacturers.
Women's footwear.		
Children's footwear.		
Slippers of felt, leather and fabric.		
Made-to-measure footwear.	}	Mainly small establishments, sometimes doing both. There is also some specialist manufacturing of riding-boots, sports boots, and other boots and shoes.
Orthopaedic footwear.		

FOOTWEAR STOCK, ACCESSORIES AND FINDINGS—

Toe puffs and stiffeners.
Heels, boot and shoe, of leather or wood.
Insoles.
Linings.
Sole-cutting—inner and outer.
Sewing.
Uppers.
Boot and shoe accessories, findings and ornaments.
Wood lasts, tacks, heel pins, adhesives.
Patterns.

In 1949-50 there were 66 establishments compared with 50 in 1948-49 wholly or mainly engaged in these activities. Most of the establishments are small and confine their operations to one or two of the activities shown at the left. In 1948-49 three of the companies employed between 51 and 100 persons; (these companies associating most of the service activities to the footwear industry). Of the remainder of establishments, 29 employed up to 10 persons and 18 from 11 to 50 persons.

FOOTWEAR REPAIR—

Repairers equipped for machine sole-sewing.
Repairers not equipped for machine sole-sewing.
Trade sole-sewers (usually serving only footwear repairers).

In 1949-50 there were 1,451 establishments compared with 1,481 in 1948-49, of which 89 per cent. were one-to-three-man shops widely spread throughout the Commonwealth. In 1948-49, 1,331 of the total establishments employed under 4 persons, 128 employed from 4 to 10 persons, 18 from 11 to 20 persons, and only 4 from 21 to 50 persons.

Part Two: Outline of Capacity of Manufacturing Activities

MANUFACTURE of clothing, the making up of manchester and napery, and manufacture of footwear constitute one of the major groups of industrial activities in Australia. For 1949-50 the value of output of manufacturing activities outlined in Part One and below for factories wholly or mainly engaged in those activities was over £148 million, nearly one-twelfth of value of output for all activities covered in this study.

CLOTHING MANUFACTURE AND MAKING-UP OF MANCHESTER AND NAPERY

The present productive capacity of the clothing and whitework industry (about 5,190 establishments) if fully used is probably sufficient to supply the whole of Australia's requirements, and with projected expansion could result in capacity in excess of requirements. Some labour and material shortages were evident in the early post-war period and imports of clothing were maintained at a high level. Towards the latter part of 1951 the consumer demand for most items of clothing declined. This decline was caused by consumer resistance to higher prices of clothing and by heavy stocking of clothing, including imported stocks, by wholesalers, retailers, and consumers. The restrictive credit policy of the Commonwealth Government then prompted wholesalers and retailers to reduce the volume of stocks.

All imports into Australia (from March, 1952) are now subject to licence—see Appendix II. Under these regulations imports of clothing and of textiles for clothing will be greatly curtailed. The effect of these restrictions may not be apparent for some time, in view of the level of stocks at present held in Australia.

It seems that keen competition can be expected in the industry at least until the population of Australia is considerably increased.

The greatest concentration of clothing manufacturing factories occurs in New South Wales and Victoria. However, the expansion of the industry in Queensland and South Australia is significant in relation to the number of new and established firms and the quality of clothing now being produced in those States.

Dependence on Imported Materials

The Australian clothing industry is supplied with the major part of its requirements of worsted and woollen cloths and tweeds from Australian manufacturers, but it is dependent on overseas suppliers for a large part of its cotton and rayon piecegoods requirements.

Tailoring is well established in Australia. Many establishments are situated in capital and large provincial cities, and there is at least one tailor in most towns of the Commonwealth. Some tailoring firms are large, employing many persons, but most establishments are small enterprises employing one or two or a few employees in a workroom. A small number of tailors would not be classified as a factory, where the proprietor concerns himself only with measuring, cutting and fitting, the machining and pressing being done at a factory

Australian wool-piecegoods manufacturers have plant capacity to supply all of the requirements of clothing manufacturers in Australia for both woollen and worsted cloths. Imports, however, had in 1951 risen to about 20 per cent. of local production levels. A small quantity of high-priced luxury and novelty lines is always supplied from overseas, but is a minute proportion of total requirements.

Cotton cloths, important materials for the clothing trade, of which most have to be obtained from overseas sources, include men's shirting fabrics; printed, plain and fancy fabrics for women's and children's outerwear; underwear, corsetry and nightwear fabrics; and linings and interlinings. Of the cotton piecegoods required by the clothing industry, only the heavier-weight cloths—drills, denims, dungarees, jeans, cotton tweeds, duck—and a small quantity of head cloth and flannelette, are made in Australia.

The clothing industry is dependent on overseas sources of supply for over 80 per cent. of its requirements of rayon woven fabrics. Although manufacturers of rayon piecegoods in Australia produce a wide range of cloths, including taffetas, linings, underwear fabrics, outerwear fabrics (crepes, satins, alpacas, etc.), shirtings, sheers, gabardines, chiffons, failles, shoe fabric, light fabrics, necktie fabrics and spun rayons, total production is as yet not nearly sufficient to supply local requirements.

Imports of sewing and embroidery cottons and silks are also necessary to supply the clothing industry's requirements.

The major part of the knitting industry's requirements of wool and of the coarser-count cotton yarns are supplied by local spinners, but all of the rayon, nylon and silk yarns and most of the fine-count cotton yarns have to be obtained from overseas.

TAILORING

providing such a trade service. A shortage of tailors has existed for some years.

The greater supply of ready-made clothing in medium and good qualities, in multiple-sized fittings, and at lower prices than tailor-made apparel, has modified the demand for tailored-to-measure clothes, and is continuing to do so.

Details of the quantity of tailored-to-measure clothes cannot be provided, as such information is not collected.

READY-MADE OUTERWEAR

Considerable expansion has occurred in post-war years in the manufacture of ready-made outerwear (not including dresses and mantles). Technical improvements in production were brought to Australia by linking up United Kingdom or U.S.A. manufacturers with manufacturers in Australia. Much capital was invested in new or extended plants. One factor which helped the post-war expansion was the intrusion into tailored qualities, as mentioned above, other factors were the steady population increase and the generally high and sustained consumer buying resulting from full employment throughout the Commonwealth. From the beginning of 1952, a decline in trade, caused by consumer resistance to higher prices of clothing and the competition of imported goods, has been marked throughout the industry. By May, 1952, a number of clothing factories were working on a part-time basis.

However, manufacturers were hopeful that the Commonwealth Government's import restrictions which were invoked on 8th March, 1952, would bolster trade.

Specialist manufacturing is extending, examples being "teen-age" outerwear, men's trousers of advertised "brand-name" quality, women's skirts, sports and leisure clothing.

The ready-made section has sufficient productive capacity to meet the demand. A shortage of skilled labour was experienced in the post-war years, but by the end of 1951 this shortage had been overcome.

Details of the quantity of ready-made outerwear cannot be provided, as such information is not collected.

The imports of ready-made outerwear into Australia for the years 1948-49, 1949-50 and 1950-51 were as follows—

IMPORTS:	1948-49		1949-50		1950-51	
	no.	£	no.	£	no.	£
Costumes, Dresses and Robes—						
Wool or containing wool	6,784	87,154	8,263	106,969	9,290	116,678
Silk or containing silk not including wool	360	7,013	507	6,856	806	16,086
Other materials, n.e.i.	3,597	25,093	2,975	26,910	5,314	41,723
Blouses and Skirts—						
Wool or containing wool	24,079	57,444	47,184	109,231	47,742	126,286
Silk or containing silk not containing wool	483	1,665	815	1,138	20,854	14,165
Other materials, n.e.i.	1,026	2,121	3,026	3,819	27,381	19,467
Coats, Girls—						
Wool or containing wool	2,180	8,218	7,583	23,350	8,592	29,938
Silk or containing silk not containing wool	6	26	41	121	106	345
Other materials, n.e.i.	1,070	3,054	4,083	6,581	6,866	9,501
Coats, Women's—						
Wool or containing wool	14,039	149,302	23,797	229,218	34,910	322,774
Silk or containing silk not containing wool	80	417	460	2,407	480	2,587
Other materials, n.e.i.	14,404	53,038	19,490	67,049	15,219	42,163
Overcoats and Suits—						
Men's with chest measurement of over 34 in.	137,210	979,665	127,256	924,533	179,651	1,383,209
Boys' and Youths'	7,360	20,471	5,002	14,509	4,700	17,861
Coats and Vests—						
Men's with chest measurement of 34 in. and over	40,229	125,215	27,999	109,717	37,396	174,806
Boys' and Youths'	2,749	2,123	1,820	2,559	3,932	6,107
Trousers and Knickers—						
With waist measurement of 31 in. and over	24,908	74,478	28,038	85,004	18,247	74,857
With waist measurement of less than 31 in.	2,363	5,347	4,014	10,242	4,184	7,896
Outer Garments, not Knitted or Lock-stitched, n.e.i., Including Dressing Gowns, Kimonos, Bath Gowns	3,811	11,260	4,850	14,520	8,577	22,150

DRESSMAKING

Dressmaking is firmly established in Australia. The main factories are at Melbourne and Sydney, where the bulk of the garments is produced. There are, however, several decentralised factories making frocks, as well as a large number of small dressmaking establishments catering for the "made-to-measure" trade. The industry is highly competitive, and a number of manufacturers send representatives abroad to study production methods, techniques and fashions, also to purchase model garments for reproduction in Australia. There has been some linking up with overseas manufacturing companies to enable the use in Australia of overseas designs, methods and techniques.

Much development and expansion has taken place since the end of the war in manufacturing dresses, infants and 'teenage frocks, chenille garments, sun and sports frocks, and accessories.

A large and important section of clothing manufacturing is the making-up of chenille garments and products, both by local manufacturers of chenille and makers-up of imported chenille. Some expansion was planned by new and established firms, mostly in Vic-

toria and New South Wales, but because of the economic condition which developed during early 1952 many of these projects have been deferred. Sufficient productive capacity for local requirements is said to exist in this branch of the industry, and it is meeting the demand.

Details of quantities of articles produced by dressmakers in Australia cannot be provided, as such information is not collected.

Imports of the main materials, not all of which would be used for dressmaking, but are included here for convenience, are as follows—

IMPORTS:	1948-49	1949-50	1950-51
	m.sq.yds.	m.sq.yds.	m.sq.yds.
Flannelette	23.0	19.8	15.9
Cotton piecegoods, n.e.i., containing wool or other synthetic fibres	1.8	2.3	6.1
Cotton, grey, unbleached	32.1	27.0	47.1
Cotton, white, bleached	51.8	30.8	38.2
Cotton, printed	40.5	40.1	37.1
Cotton, dyed or coloured, n.e.i.	54.4	59.2	76.6
Rayon piecegoods	65.7	56.6	72.3
Woollen and worsted piecegoods	7.6	9.8	6.4

WATERPROOFED AND RAINPROOFED GARMENTS

A few vigorous manufacturers, principally those with spreading plants, dominate the manufacture of waterproofed and rainproofed garments in Australia. Production by manufacturers without spreading plant has been restricted by shortage of rubberised and other waterproofed fabrics, but despite shortages the capacity for making waterproofed garments has been extended. Notable among the companies which have added to the production capacity of Australia's waterproof-garment manufacturing, are some United Kingdom companies, which are producing raincoats and which plan to make other rainproof garments. The principal items of production of waterproof and oilskin clothing in 1948-49 were —

PRODUCTION:		1948-49
Coats—		no.
Rubberised		332,640
Oiled		20,013
Waterproofed (including plastic) ..		107,235
Hats—rubberised, oiled and water-proofed		60,396

Production of the above items and of rainproofed overcoats has increased considerably since 1948-49. Imports into Australia of waterproofed materials during 1948-49 totalled 1.18 million square yards, and 1.19 million square yards in 1949-50, excluding rubberised sheeting and plastic sheetings. Some of the larger waterproofing firms engage in commission spreading for the footwear, rubber and other industries.

FUR GARMENTS AND ACCESSORIES

The manufacture of fur garments and accessories in Australia is a firmly-established trade with a high degree of specialisation. A large quantity of the fur skins used are imported. Several old-established firms have grown from small beginnings to large businesses which now cater for most of the Australian demand for fur apparel. The industry is broadly divided into two branches: fur and skin dressing/dyeing, and making-up; some establishments, however, combine the two activities. Only one or two firms have produced high-quality imitation beaver fur (usually called beaverine or mouton) from woolled sheep-skins, but coats made therefrom are heavy compared with real fur coats; that disadvantage, with the rising price of wool, resulted in a very low demand. A small number of new manufacturers of fur coats have become productive in the post-war period, and general expansion of established

firms has also taken place. The industry is capable of meeting the demand made upon it.

Imports into Australia of furs and other skins except rabbit skins, dressed or prepared for making-up during 1948-49 totalled 17,069 lb., valued at £58,298, and in 1949-50 totalled 20,936 lb., valued at £61,613. The value of furs and skins partly or wholly made up into apparel or other articles during the same periods were £4,816 in 1948-49 and £7,167 in 1949-50. The greater part of these furs or fur products came from the United Kingdom. Exports from Australia during 1948-49 of fur and other skins dressed or prepared, and articles made thereof were valued at £14,630, and in 1949-50, £74,026 of which the greatest amount was shipped to the United Kingdom.

SHIRTS, UNDERCLOTHING, SLEEPING WEAR, ETC., MANCHESTER, NAPERY

Much development has taken place in the post-war period in the manufacture of SHIRTS, PYJAMAS AND OTHER SIMILAR GARMENTS. Many established firms have increased their capital for purposes of carrying out expansion programmes, and some large new companies have been formed and have begun production. Technical improvements and overseas patterns have been brought to Australia through affiliations between overseas organisations and Australian companies.

The productive capacity of the shirt-making factories is sufficient to meet the normal demands of the Australian market. Fusing of collars has become a specialised branch of collar making, some new firms being now so engaged; most of the fusing of collars, however, is carried on by the main manufacturers.

Underclothes, overalls, professional coats, smocks and wraps, are made in some white-work factories; some large factories are wholly engaged in making overalls and professional coats. A shortage of skilled female labour exists in the underclothing branch of the industry.

Swimsuits and beach leisure wear are made both by specialists and in association with other products.

Underclothing manufacture on commission and sale basis in 1948-49 was, for principal items—

PRODUCTION:	Commission	For Sale	Total Value
Men's and Boys'—	doz.	doz.	£
Shirts	325,182	530,822	4,538,131
Collars (excluding those sold with shirts)	70	98,371	76,171
Undershirts, under-pants and combinations	25,526	254,347	647,521
Pyjamas	84,575	134,498	1,408,655
Women's and Girls'—			
Underwear	21,261	494,576	1,678,407
Pyjamas and night-dresses	16,336	106,776	1,050,922

Production of men's and boys' shirts in 1949-50 totalled 881,000 dozen and in 1950-51, 872,000 dozen; men's and boys' pyjamas totalled 191,000 dozen and 153,000 dozen during the same periods.

Exports of sleeping wear, underwear, shirts and similar garments (not knitted or lockstitched) from Australia in 1947-48 were valued at £47,984, in 1948-49, £64,538, and in 1949-50, £23,926. The greater part of these exports in 1947-48 were shipped to the Pacific islands, while in 1948-49 Denmark was the largest single importer and in 1949-50 the United Kingdom.

There has been a marked increase in the value of imports (quantity is not recorded). In 1947-48 imports of sleeping wear, underwear, shirts, sewn garments of a like nature (but not including knitted or lockstitched garments or attire), were valued at £31,165; in 1948-49, the value of imports had risen to £221,933; and

in 1949-50 was £211,570. The greatest part of these imports came from the United Kingdom.

MANCHESTER and NAPERY are made-up by many firms. Manufacture includes making-up of tablecloths, table napkins, sheets and pillow cases, napkins and aprons, mostly from imported materials. The production from these firms is usually made from materials supplied by and for sale by the leading wholesale ware-

houses. One large company spinning and weaving cotton makes sheeting, pillow cloth, headcloth, towels, and towelling, and makes up sheets and pillow-cases.

Imports into Australia of the principal items of manchester and napery are considerable. The following table shows main items imported during 1948-49, 1949-50 and 1950-51—

IMPORTS:	1948-49		1949-50		1950-51	
	doz.	£	doz.	£	doz.	£
Pillow-cases, pillow covers, bolster cases	—	8,274	—	7,667	—	19,442
Sheets, counterpanes, bedspreads	—	147,175	—	123,025	—	247,877
Quilts	—	187,939	—	225,281	—	375,792
Serviettes (unboxed, unhemmed)	23,191	34,194	18,404	19,207	22,639	28,438
Serviettes	55,578	28,999	48,565	31,585	51,022	28,601
Tablecloths (unhemmed)	35,268	199,270	36,921	137,125	66,074	267,981
Tablecloths	31,528	227,798	26,297	189,587	42,830	261,967
Articles of furnishing, drapery and napery, d'oyleys, tray cloths, table covers, table mats, etc.	—	158,599	—	139,604	—	385,773

Exports from Australia in 1947-48, 1948-49 and 1949-50 of articles of furnishing drapery and napery, including bed linen, table linen, toilet linen, except towels and towelling, were valued at £38,269, £44,705, and £72,607, respectively.

EMBROIDERY AND ART NEEDLEWORK establishments in Australia are not great in number nor in size except one, which is the only plant in Australia equipped with automatic machines for embroidery in the piece, including broderie anglaise and needlerun (see Chapter 15, "Textiles, Felting, Cordage", page 405, for description of this establishment and of the large manufacturing group of which it is a unit). Production sometimes includes associated goods such as paper transfers, linen tracings, crochet work, tapestry and petit-point work. Badge embroidering and school emblems form much of the permanent type

of work carried out, while ecclesiastical and lodge-regalia adornments also form a large part of the regular work. Special emblems and banners are a further branch of the trade. There is a strong demand for embroidering services in Australia and most firms so engaged are fully occupied. PLEATING is sometimes carried out in conjunction with embroidering, but there are establishments wholly employed in pleating work, some pleating is undertaken on a commission basis, for factories and dress-making establishments. HEMSTITCHING is another branch of work which is carried out as a service to the manufacturers; most of the establishments are small. Some SCALLOPING is done by the same firms which do hemstitching. SPOKESTITCHING, BRAIDING, BEADING, PIN TUCKING, APPLIQUE and CORNELLI work, are other special types of work which are performed in service enterprises.

KNITTED GOODS

Manufacture of knitted goods is well established in Australia, employing in 1948-49 about 21,000 persons, and in 1949-50, 21,577, compared with 57,000 in tailoring, ready-made clothing and dressmaking. The knitting industry is mainly located in Victoria and New South Wales, two-thirds of employment being in the Victorian factories.

The industry is mainly a garment-producing one, in that the bulk of yarn fabricated is made into garments in the knitting mills, but some mills do manufacture knitted piecegoods for sale as such. A small number of large knitting mills spin their wool yarn and cotton yarn requirements, while others are dependent upon local spinners and/or overseas suppliers for their requirements of these yarns. Some mills confine their activities to one type of production, while others manufacture two or more classes of knitted goods. A substantial quantity of summer underwear is manufactured from cotton and rayon yarns, while wool, or wool-and-cotton mixtures are knitted for most winter-wearing undergarments.

There are less than twenty mills in Australia producing women's, maids' and girls' FULL-FASHIONED HOSIERY, and some of the mills are capable of producing considerable quantities of that type of hosiery. Demand for women's, maids' and girls' pure-silk hosiery has diminished in favour of nylon stockings, but there is still a demand for silk hosiery. There is little demand for women's CIRCULAR HOSIERY, except for circular nylon hosiery for which demand is small in comparison with that for full-fashioned nylon hosiery.

With the advent of nylon as the premier fibre for the manufacture of women's hosiery, demand has increased progressively for finer-count yarns. The hosiery industry in Australia at first used 45-denier nylon yarn, the only weight of yarn then available; later, 30-denier yarn was used when it became available and now a large quantity of 15-denier yarn is being used. If the Australian hosiery industry follows the same pattern as that of the United States of America, and there appears every indication that this will be so, then the largest quantity of nylon stockings made in this country will be from 15-denier yarn.

The hosiery industry in Australia has sufficient capacity to cater for local requirements of fine weight and gauge full-fashioned hosiery. At present, production of full-fashioned nylon hosiery in Australia is not quite sufficient to meet demand, the difference between production and consumption being met by imports, mainly from the United Kingdom. However, imports of nylon hosiery arrived in such quantities in the period 1st July to 31st December, 1951—7,797 dozen pairs of circular hosiery valued at £18,335, and 239,194 dozen pairs of full-fashioned hosiery valued at £1,001,247—that the industry has asked for the Industries Preservation Act to be invoked and anti-dumping duties thus applied to imports. The Act was enforced and now (at March, 1952) a special deposit, as a bond, must be paid on each consignment of imported stockings pending a hearing of the case by the Australian Tariff Board. If the charge of dumping is not sustained the deposits will be refunded to the

importers. The quality of Australian-made full-fashioned hosiery is excellent, equal to, and in some cases better than, imported hosiery. Supplies of nylon yarn increased considerably during 1951. The local industry can supply practically all of Australia's requirements for full-fashioned hosiery.

The manufacture of MEN'S HALF HOSE is carried out by large, medium-sized and small firms, sometimes in association with the production of other items of knitted apparel. Most of the half hose was previously manufactured from wool and wool mixtures. In recent times, however, the percentage of wool used has been reduced in favour of other fibres due to price considerations. The existing factories have more than sufficient plant capacity to meet local requirements.

BOYS' HOSE AND GIRLS' SOCKS are made sometimes in conjunction with other branches of knitwear manufacture and in some cases by firms that specialise in these items. Plant capacity is ample to meet local requirements.

Manufacture of KNITTED SWIMSUITS is a substantial branch of the knitting industry; some large companies are engaged, and competition is keen.

Many small knitters are engaged in production of SHAWLS, COT COVERS, INFANTS'

WEAR, SCARVES, MITTENS, GLOVES and NECKTIES.

A small section of the industry does not knit, but makes-up garments from fabric purchased from knitters.

During the 1939-45 War several new manufacturers entered the knitting industry, while some existing mills extended their plants. It is difficult to estimate the overall productive capacity, but in general terms, it may be said that plant capacity is more than adequate to meet the present requirements of the Australian market. Due to extensive use during the war years some of the plant is at a low state of efficiency, but other equipment has been replaced by more modern equipment. Many mills are passing through a period of plant rejuvenation, existing plants being reconditioned and additional plant of the latest type has, or is being, acquired. It is considered that the industry has not yet completed its replenishment of equipment and that additional modern and speedy plant will be sought.

As a guide to the extent of manufacturing capacity of the knitting industry, the amount of yarn used in 1938-39 and for the post-war years 1945-46 to 1949-50 is shown below—

YARN USED	Worsted	Woollen (c)	Cotton '000 lbs.	Cotton Merc.	Silk	Nylon	Rayon	Other
1938-39	5,582	168	4,245	876	1,143	(b)	5,281	(a)
1945-46	8,022	182	5,955	877	(a)	(b)	5,984	(a)
1946-47	9,342	194	7,939	893	103	(b)	5,545	(a)
1947-48	9,647	142	8,726	882	326	(b)	5,227	89
1948-49	9,807	173	8,674	770	338	195	6,761	52
1949-50	8,525	336	8,774	568	196	531	6,513	23

(a) Not available for publication.

(b) Details not collected.

(c) Includes some mixture.

The following table shows production of articles produced in hosiery and knitting mills

in Australia for the years 1938-39 and 1949-50—

PRODUCTION:	1938-39	1949-50	1938-39	1949-50
	doz.pr.	doz.pr.	£	£
Stockings and Socks—				
MEN'S—				
Wholly of wool	316,414	482,737	276,023	1,187,721
Wholly of other material	73,144	40,764	42,478	61,570
Woollen mixtures	593,135	624,978	432,831	1,540,984
Other mixtures	151,711	10,151	79,096	23,284
Total	1,134,404	1,158,630	830,428	2,813,559
WOMEN'S—				
Wholly of silk	808,814	307,101	1,190,315	1,154,166
Wholly of rayon	135,467	58,794	69,109	134,562
Wholly of nylon	—	704,780	—	3,246,320
Wholly of other materials	132,716	276,187	99,631	535,296
Silk mixtures	668,250	57,143	1,070,706	190,977
Rayon mixtures	299,839	52,527	190,846	83,287
Other mixtures	91,092	281,055	55,515	378,669
Total	2,136,178	1,737,587	2,676,122	5,723,277
CHILDREN'S—				
Wholly of wool	188,464	234,339	124,294	341,634
Wholly of other materials	21,215	91,166	12,281	99,524
Rayon mixtures	282,771	101,959	108,814	94,219
Cotton mixtures	53,273	140,059	19,491	148,025
Other mixtures	65,767	—	37,999	—
Total	611,490	567,523	302,879	683,402
Articles of Wool or Predominantly Wool—				
Underwear	doz.	doz.	£	£
Nightwear (women's and girls')	379,879	404,237	517,248	1,611,919
Costumes, robes, etc.	5,228	2,446	25,017	45,825
Bathing suits, etc.	2,323	4,708	33,669	148,151
Cardigans, jumpers, etc.—	77,077	34,330	282,598	270,608
Boys' and girls' (chest under 34 in.)	76,252	148,060	174,776	1,297,103
Men's and women's (chest 34 in. and over)	203,508	262,906	947,090	3,970,274
Articles of Rayon or Predominantly Rayon—				
Underwear	986,198	878,833	1,101,650	2,918,046
Nightwear (women's and girls')	47,839	100,106	115,419	937,644
Costumes, robes, etc.	2,105	2,803	8,714	51,696
Bathing suits, etc.	(a)	18,053	(a)	298,853
Cardigans, jumpers, etc.—	—	451	—	6,099
Boys' and girls' (chest under 34 in.)	49,450	7,678	54,288	52,295
Men's and women's (chest 34 in. and over)	—	—	—	—

Articles of Cotton or Predominantly Cotton—

Underwear	678,021	1,360,990	477,384	2,852,793
Nightwear (women's and girls')	1,075	30,230	5,979	312,983
Costumes, robes, etc.	9,657	(d)	15,681	(d)
Bathing suits, etc.	(a)	10,962	(a)	67,195
Cardigans, jumpers, etc.—				
Boys' and girls' (chest under 34 in.)	67	(d)	223	(d)
Men's and women's (chest 34 in. and over)	12,395	85,261	23,769	349,071

Articles of Other Fibres (including Silk)—

Underwear	77,853	33,052	54,029	75,099
Nightwear (women's and girls')	(b)	—	(b)	—
Costumes, robes, etc.	—	1,487	—	31,045
Bathing suits, etc. (c)	1,784	5,317	7,085	86,976
Cardigans, jumpers, etc.—				
Boys' and girls' (chest under 34 in.)	—	51,295	—	264,170
Men's and women's (chest 34 in. and over)	(b)	14,040	(b)	104,161

(a) Not available for publication; included with other fibres.

(b) Not available for publication.

(c) Includes rayon and cotton.

(d) Included with "Articles of Other Fibres (including Silk)".

Production in 1950-51 of women's, maids' and girls' full-fashioned and circular hosiery reached 1,486,000 dozen pairs; anklets 381,800 dozen pairs; men's and boys' hose 1,546,400 dozen pairs; and children's hose 590,300 dozen pairs.

Production of knitted underwear (made in knitting mills), in 1950-51, totalled 818,000 dozens of men's, 1,575,000 dozens of women's and 742,000 dozens of children's.

Production of knitted cardigans, jumpers and sweaters, for men, women, boys and girls

totalled 539,000 dozen in 1950-51; knitted bathing suits totalled 61,000 dozen.

Pre-war, some exports of hosiery and knitted goods were made, but at the present practically all export markets have dried up and very little export trade is being carried on. In view of the existing plant capacity, and the doubt regarding the establishment of a large-scale export trade in the near future, it does not seem desirable to expand further the production capacity of the industry to any great extent. The exports of knitted products from Australia during 1948-49, 1949-50 and 1950-51 were as follows—

EXPORTS:	1948-49		1949-50		1950-51	
	doz.prs.	£	doz.prs.	£	doz.prs.	£
Socks and Stockings—						
Wool or containing wool—						
Men's half-hose	4,602	8,257	10,262	17,561	13,264	19,862
Silk—Women's and children's stockings, including stockings worn below the knee	120	99	96	375	376	732
Rayon or other synthetic fibre—Women's and children's stockings, including stockings worn below the knee	162	295	807	3,219	309	1,710
Socks and stockings, n.e.i.	2,247	3,875	4,317	6,070	1,258	2,781
Apparel, Knitted—						
Costumes, dresses and robes	—	52	—	174	—	6,802
Blouses and skirts	—	65	—	299	—	278
Coats, jumpers, cardigans, sweaters, and similar garments	—	42,291	—	26,309	—	43,567
Underwear	—	44,531	—	48,971	—	59,981
Bathing costumes	—	7,090	—	6,321	—	5,796
Hosiery (other than socks and stockings), and articles of apparel, n.e.i., made from knitted or lockstitched piecegoods	—	546	—	32	—	300

The following table shows imports of hosiery and knitted goods for the years 1948-49 and

1949-50 and Customs clearances for 1950-51—

IMPORTS:	1948-49		1949-50		1950-51	
	doz.prs.	£	doz.prs.	£	doz.prs.	£
Socks and Stockings—						
WOOL OR CONTAINING WOOL—						
Children's socks	127,680	108,806	66,693	57,216	74,918	78,670
Children's three-quarter hose, women's and girls' sports hose	88,683	143,300	32,646	47,102	22,590	35,907
Women's and children's stockings (including stockings worn below the knee)—						
Circular	3,857	9,171	770	1,837	503	1,412
Other than circular	13,603	48,456	2,440	9,355	1,683	8,030
Men's and boys' full golf hose	7,849	14,636	4,599	10,312	865	1,818
Men's half hose	131,645	323,511	81,580	201,740	35,416	99,153
SILK—						
Socks, children's	1,080	597	941	618	1,410	919
Women's and children's stockings—						
Circular	189	583	50	74	—	—
Other than circular	16,413	49,400	1,746	6,687	2,344	8,513
Men's half-hose	79	156	—	—	47	241
RAYON AND OTHER SYNTHETIC FIBRE—						
Socks, children's	20,587	13,160	26,701	17,244	16,801	11,297
Children's three-quarter hose, women's and girls' sports socks	1,647	1,178	5,310	3,922	7,025	5,615
Women's and children's stockings—						
Circular	13,234	32,041	Nylon circular—		1,568	3,733
			7,240	18,515		
			Except nylon—			
			3,771	4,490	967	1,264
Other than circular	321,390	1,273,053	Nylon other than circular—		254,533	1,064,685
			321,415	1,298,109		
			Except nylon other than circular—			
			2,613	6,829	2,577	7,135

Men's half-hose	1,985	2,381	2,170	2,599	1,709	3,615
OTHER (NOT BEING WOOL, SILK, RAYON, OR OTHER SYNTHETIC FIBRE)—						
Socks, children's	192,357	129,181	69,933	43,196	55,732	36,627
Children's three-quarter hose, women's and girls' sports socks	24,938	16,771	17,427	14,640	14,426	14,463
Women's and children's stockings—						
Circular	13,849	22,269	11,000	14,050	13,860	19,090
Other than circular	154,970	432,029	21,667	57,576	31,170	86,688
Men's half-hose	15,942	19,775	7,727	10,054	6,300	12,435
Socks and stockings, n.e.i.	2,195	3,666	990	1,583	820	1,459
Apparel and Attire, Knitted or Made from Knitted or Lockstitched Piece- goods—						
COSTUMES, DRESSES AND ROBES—	no.	£	no.	£	no.	£
Wool or containing wool	5,647	30,493	10,877	39,682	15,279	50,089
Silk or containing silk, but not containing wool	2	14	22	317	40	667
Other materials, n.e.i.	484	1,408	2,706	1,585	1,252	1,176
BLOUSES AND SKIRTS—						
Wool or containing wool	1,553	1,426	1,774	1,602	1,931	2,986
Silk or containing silk, but not containing wool	12	3	1,150	1,082	70	199
Other materials, n.e.i.	15,241	4,460	4,899	1,546	2,559	1,861
COATS, JUMPERS, CARDIGANS, SWEATERS, AND SIMILAR GARMENTS—						
Wool or containing wool	216,043	260,858	558,180	518,777	577,512	566,167
Silk or containing silk	12	2	200	317	1,290	1,844
Other materials, n.e.i.	11,576	8,927	8,939	6,788	19,858	19,608
UNDERWEAR—						
Wool or containing wool	108,878	47,778	101,148	44,067	49,461	37,694
Silk or containing silk, but not containing wool	21,627	6,482	32,274	8,005	7,266	5,675
Other materials, n.e.i.	2,450,034	511,233	921,229	180,834	190,039	88,254
BATHING COSTUMES—						
Wool or containing wool	462	910	4	6	25	46
Silk or containing silk	360	700	273	344	291	576
Other materials, n.e.i.	3,783	6,128	1,837	811	2,518	3,174
Hosiery (other than Socks and Stockings) and articles of apparel, n.e.i., made from knitted or lockstitched piecegoods	—	10,795	—	27,099	—	140,086

FOUNDATION GARMENTS

The foundation-garment industry in Australia is efficiently organised and energetically operated—Australian-made foundation garments are said to be equal to the world's best in their various grades. The industry has expanded substantially in recent years. The largest of the foundation-garment makers in Australia has set up factories in England and New Zealand, has branch factories in two country towns in New South Wales, and has two branch factories in the suburbs of Sydney, in addition to the parent factory at Sydney. Some other firms also have decentralised factories where parts of or whole garments are produced.

It is a fashion-conscious industry, and the Australian manufacturers regularly send representatives overseas to study production methods, fashion trends, changes in materials and techniques. American techniques for foundation-garment manufacturing have been brought to Australia by Australian companies linking with or making under licence to American firms. Many well-known U.S. brands, and at least one French brand, of foundation garments are manufactured in Australia.

Most of the main manufacturers in Australia make a wide range of products; some produce many different styles of garments in a variety of fittings, each in an individual size range. Some firms specialise in made-to-measure and/or surgical foundation garments.

Capacity to produce CORSETRY and BRASSIERES, on a one-shift basis, is, in general, adequate to the demand. The industry in 1949-50 produced 102,800 dozen corsets, 9,118 dozen corselets, 316,612 dozen brassieres, 14,079 dozen suspender belts and 4,722 dozen surgical belts.

Exports from Australia of corsets and other body supporting garments, except surgical, in 1948-49 were valued at £9,488, and in 1949-50 at £3,739. Pre-war, Australia exported small quantities of foundation garments, mainly to South Africa, but the local market has absorbed practically the whole of the post-war output other than token shipments.

Imports of corsets and elastic fabrics and products for the years 1948-49, 1949-50 and 1950-51 were as follows—

IMPORTS:	1948-49		1949-50		1950-51	
	no.	£	no.	£	no.	£
Corsets	36,909	51,045	15,705	35,532	20,112	53,770
Brassieres and other supporting garments, except surgical, n.e.i.	—	6,158	—	9,958	—	18,585
Surgical belts, braces, breast supports, pads, trusses, vaccination shields	—	5,482	—	7,305	—	10,919
Elastics, knitted in tubular form	sq.yds. 7,368	7,167	sq.yds. 14,024	12,910	sq.yds. 9,624	13,628
Elastics, other, under 1 inch	gr.lin.yds. 92,915	103,869	gr.lin.yds. 56,492	68,207	gr.lin.yds. 113,034	109,164
Elastics, other, n.e.i.	sq.yds. 441,013	291,460	sq.yds. 341,432	315,030	sq.yds. 575,736	593,558
Elastic stockings, leggings, thighpieces, anklets, kneecaps, wristlets and athletic straps, bandages	—	4,295	—	8,187	—	14,748

HANDKERCHIEFS

Handkerchief manufacture in Australia is entirely of imported materials; only stitching and edging of men's handkerchiefs, and stitching, edging and embroidering of women's handkerchiefs is carried out in Australia. Three of the Sydney manufacturers have given consideration to establishing a joint company for spinning and weaving handkerchief materials, but discarded the plan, due to the high cost of plant and insufficient turnover to warrant the expenditure. Much of the plant for

handkerchief edging and embroidering arrived in Australia in 1938 and the early war years, and it is considered ample capacity for all production of handkerchiefs other than high-quality embroidered is now installed. The industry in 1949-50 produced 811,355 dozen men's and boys' handkerchiefs and 823,465 dozen women's and girls' handkerchiefs.

Imports of handkerchiefs for the years 1948-49, 1949-50 and 1950-51 were considerable—

IMPORTS:	1948-49		1949-50		1950-51	
	doz.	£	doz.	£	doz.	£
Handkerchiefs, unpressed and unboxed ...	41,886	23,492	22,631	5,617	25,369	7,076
Otherwise ...	1,878,145	1,084,798	1,472,065	751,453	1,839,487	919,984

NECKTIES

Neckties are made in Australia mainly from imported tie silks. Woven wool tie-fabric and knitted ties are made in Australia. In 1948-49, tie production was 486,659 dozen. Imports

of ties, mainly from United Kingdom, for the years 1947-48 were 8,182 dozen (£22,911); 1948-49, 40,792 dozen (£78,887); 1949-50, 10,722 dozen (£25,328); and 1950-51, 46,474 dozen (£100,644).

HEAD SQUARES AND SCARVES

Head squares and scarves are made from a variety of materials. The bulk of the production other than of knitted or woven scarves is made by small firms situated mainly in Mel-

bourne and Sydney. Some of the screen-printing firms produce printed silk, rayon scarves and ties.

HATS AND CAPS, MILLINERY AND ARTIFICIAL FLOWERS

FUR-FELT HAT manufacture in Australia is well served by the plentiful supply of rabbit-skins available; a large surplus of skins is exported. Australian fur-felt hat factories engaged in production of men's hats are modelled after the English style inasmuch as hats are made from fur to finished product in one factory. English felt-hat craftsmen have established the industry soundly in Australia with the result that the best-quality Australian fur-felt hats compare favourably with imported hats. WOOL-FELT HATS are made in Australia by a few manufacturers, mainly for the millinery trade.

Present production of men's hats is sufficient to supply the Australian demand, and oversea demands for fur-felt and wool-felt hats and hoods are being met. There is ample established manufacturing capacity to satisfy the local and export markets.

The industry in 1948-49 used 1,529,485 lb. of rabbit skins and 256,445 lb. of scoured wool, and produced the following quantities of hats, hoods, and capelines—

PRODUCTION:	1948-49	1949-50
Fur-felt—	doz.	doz.
Hats	98,303	93,495
Hoods and capelines for sale as such	50,623	43,877
Wool-felt—		
Hats	6,255	5,209
Hoods and capelines for sale as such	93,498	49,094

Exports in 1948-49 were 3,130 dozen fur-felt hats and 11,204 dozen of wool-felt hats, mainly to Southern Rhodesia and other British countries, while in 1950-51 exports were 32 dozen of fur-felt hats and 1,311 dozen of wool-felt hats. Imports were 12,704 dozen of men's and boys' and 4,343 dozen for women's and girls' in 1948-49; and in 1950-51 totals were 9,094 dozen and 9,429 dozen respectively; in both years mainly from the United Kingdom.

HOODS for straw hats are not made in Australia. Imports in 1948-49 were 7,523 dozen and in 1950-51, 30,737 dozen hoods of Panama or

Pandan, mainly from the Netherlands East Indies. Grass or straw braids, imported mainly from Switzerland, were valued at £135,355 in 1948-49, £111,001 in 1949-50 and £90,890 in 1950-51. The quantity of STRAW HATS produced in Australia during 1948-49 was 121,870 dozen, of which 96,890 dozen were women's and girls' hats. Total production in Australia in 1949-50 was, as far as was known, slightly less than average demand requirements.

CAP MAKING is well established, mainly at Sydney and Melbourne. The production of college and school caps meets demand, some firms specialising in such products. Caps and helmets for the Armed and Public Services are usually made by the Commonwealth Clothing Factory and by specialist firms, and ample capacity for manufacture of such is available. Australian production of CAPS, BERETS and HELMETS in 1948-49 was 46,827 dozen of caps, 18,736 dozen of berets, and 11,204 dozen of helmets. Exports of hats (except felt), caps, and other headwear in 1948-49 were valued at £14,940, as compared with £12,148 in 1949-50. Hats and caps and other headwear imported during 1948-49 were valued at £558,551, and in 1949-50, £520,843; the bulk of the imports coming from the United Kingdom; included among the imports for 1948-49 were 55 dozen of firemen's helmets and miners' hats.

The style demand for MILLINERY in Australia is seasonal, but while similar styles are worn throughout the southern areas of the Commonwealth, the trend in northern Australia is to lighter millinery suited to a sub-tropical climate. A recent development is the sale of all necessary felts, straws, crowns, brims, feathers and accessories in separate but matched pieces for making-up into hats by the user. A branch of the millinery industry is catering for this "home-manufacture" market. The hat industry is able to supply the millinery trade with its requirements of fur-felt and wool-felt hoods for women's wear, about one-third of which are of rabbit-fur, the remainder

being of wool-felt. The supply of straw shapes, however, is below demand (see Straw Hats, above). Details of quantities of articles produced by milliners in Australia cannot be provided as such information is not collected.

GLOVES

There were fifty-six manufacturers of gloves in Australia in 1949-50, over half of which were located in Victoria. Products include leather and fabric dress gloves, driving, harvesting, working, housemaids' and gardening gloves. (The manufacture of rubber gloves is considered in Chapter 8, "Rubber Products".)

Before the 1939-45 War, manufacture was confined mainly to industrial types, requirements of which were supplied almost wholly by the Australian industry. The cessation of dress glove imports during the war, however, stimulated production and the industry was built up to a stage where it could supply practically all of the Australian requirements of both dress and industrial types. When imported gloves again became available on the Australian market after the war, the Australian manufacturers found that they could not compete, particularly in the higher-grade dress gloves, partly because of price and partly because of a marked consumer preference for the imported articles. As a result Australian production of gloves, particularly leather dress gloves, declined considerably; and many manufacturers diverted their activities to other fields, making gloves only intermittently or as a side line.

Production of LEATHER DRESS GLOVES declined from a peak of 69,468 dozen pairs in 1946-47, to 48,800 dozen pairs in 1948-49, only 25,000 dozen pairs in 1949-50 and 24,210 dozen pairs in 1950-51. Imports of leather gloves, on

ARTIFICIAL FLOWERS and other trimmings are made in Australia by about twenty companies. Value of production of artificial flowers during 1948-49 was £152,911, while value of other trimmings and ornaments produced amounted to £234,419.

the other hand, increased from about 25,000 dozen pairs in 1946-47 to 55,500 dozen pairs in 1947-48, 47,000 dozen pairs in 1948-49, 55,000 dozen pairs in 1949-50, and 70,237 dozen pairs in 1950-51.

FABRIC DRESS GLOVES are mostly made in Australia separately from leather gloves. Although production declined in the post-war period from 37,000 dozen pairs in 1947-48 to 27,400 dozen pairs in 1948-49, recent figures have shown a definite increase in production of fabric dress gloves—to 32,100 dozen in 1949-50 and 44,730 dozen pairs in 1950-51. Imports of gloves and mittens, other than of leather or of certain industrial types, in 1948-49 totalled 122,428 dozen pairs, valued at £282,863; in 1949-50, 113,836 dozen pairs, valued at £250,851; and in 1950-51 were 227,257 dozen pairs, valued at £474,900. (Most of these are thought to be fabric dress gloves.)

In the manufacture of dress gloves, more particularly leather, there is considerable unused capacity.

The production of INDUSTRIAL-TYPE GLOVES is sufficient to meet Australian demand. Output in 1949-50 was 154,000 dozen pairs, and in 1950-51, 195,860 dozen pairs. Imports of industrial gloves are small.

Exports of Australian-made gloves and mittens in 1948-49 were 1,180 dozen pairs, valued at £2,530; in 1949-50, 5,371 dozen pairs, £4,107; and in 1950-51, 3,266 dozen pairs, £4,617.

CLEANING AND REPAIR OF CLOTHING, NAPERY, ETC.

LAUNDRIES in Australia are fairly widespread throughout the Commonwealth, but the greatest concentration occurs in the metropolitan cities of Sydney and Melbourne. A large number of the laundries are old-established companies, some of which combine dry cleaning, pressing and dyeing services; a small number are self-service automatic laundries which use the domestic type washing machines in their establishments. Some convents also operate large laundries. There appears to be a great demand on laundry services and, apparently, insufficient establishments to cope with the present demand.

A marked increase has occurred over recent years in DRY CLEANING, PRESSING and DYEING capacity, more particularly in New South Wales and Victoria. The service is rather well organised and equipped for its work, most of the large companies having well-planned factories with continuous processing.

INVISIBLE MENDING, RENOVATION and REPAIR of clothing and fabrics is carried out by a few small specialist enterprises and by some of the dry-cleaning and pressing establishments.

THE FOOTWEAR INDUSTRY

FOOTWEAR MANUFACTURE

The footwear industry in Australia is strong and firmly established. It is an industry of great diversity, making a wide range of goods which are sold retail at prices ranging from a few shillings for a child's pair of slippers to several pounds for men's and women's dress shoes of high quality. The industry is complex both in production and marketing. There are about nine different major types of footwear production in Australia requiring different plant and different methods of manufacture. There are mass-production factories in addition to factories specialising in high-quality

footwear. Some factories manufacture for their own retail shops and some sell to wholesalers only. Other factories maintain their own stocks and sell to retailers, while others manufacture to retailers' special orders only.

The footwear industry has not yet achieved in Australia complete standardisation of fittings. Some progress has been made in the development of multiple fittings, but this has so far been confined to higher grades of footwear.

There has been substantial expansion in the industry since the end of the 1939-45 War.

Seven new companies have either recently begun production or have announced an intention to begin manufacturing footwear. Notable newcomers have entered the industry, some having United Kingdom interests and others being wholly Australian owned. Many established companies have recently increased their capital for general expansion purposes. One large organisation is a principal supplier of felt and most requisites for the manufacture of felt slippers in Australia and is also engaged in making slippers, shoes and other footwear (and has subsidiary and associate companies manufacturing textiles, felt, carpets, products of textile wastes—see close of Part One, Chapter 15, "Textiles, Felting, Cordage").

About 90 per cent. of the specialist machines used in Australian footwear factories are sold by or leased from The British United Shoe Machinery Company of Australia Pty. Ltd. (That company is a subsidiary of the British United Shoe Machinery Co. Ltd., of Leicester, England, which in turn is associated with the United Shoe Machinery Corporation of America.)

Skilled labour is in short supply. Materials, including uppers, tops and slipper forms, cork, leather and other socks and soles (except rubber) were imported to the value of £4,727 during 1948-49, £4,497 during 1949-50, and for 1950-51 were valued at £5,929. (For imports of leather see Chapter 14, "Leather and Leather Products".)

Productive capacity of the footwear industry in pre-war years was considerably in excess of local demand, but the substantial increase in capacity since the 1939-45 War has not yet become an embarrassment to the manufacturers. Demand has been maintained well above pre-war levels. However, it seems apparent that an increased export market will be needed within a short time to maintain full production with existing and projected plant capacity.

There is a tendency toward overproduction in some of the cheaper lines of leather footwear, for example, some types of children's shoes. Production of medium grades of men's

and women's footwear is about equal to the local demand, but a shortage exists in men's and women's high-grade shoes; particularly matrons' shoes. The shortage is mainly caused by the scarcity of high-grade upper leathers, and by the generally increased demand for shoes of higher grade. Slippers, sandals, moccasins, football boots (not soccer boots, which are not made in Australia), cricket boots, running spikes, boxing shoes and ballet shoes are made in sufficient quantities for local requirements, but there appears to be a shortage of orthopaedic boots and shoes.

In 1949-50, 15.35 million pairs of boots and shoes, 8.4 million pairs of slippers, and 2.1 million pairs of sandals, were made in Australia. With the exception of sandals, these production statistics show a slight increase over the 1938-39 production level. In 1950-51, production reached 16.6 million pairs of boots and shoes, 8.3 million pairs of slippers, and 1.6 million pairs of sandals. The following table shows the composition of production of boots, shoes, sandals and slippers from all factories in Australia, in 1949-50—

PRODUCTION:	Quantity	Value
Boots—	pairs	£
Men's	1,517,339	1,669,621
Women's	31,192	53,262
Children's (a)	263,734	179,838
Shoes—		
Men's	3,381,368	4,660,254
Women's	6,346,228	8,885,858
Children's (a)	3,868,834	2,600,672
Sandals—		
Men's	557,601	350,582
Women's	1,142,351	1,417,153
Children's (a)	598,782	302,063
Clogs	7,787	6,246
Slippers, Felt or Fabric—		
Men's	517,092	227,892
Women's	3,955,330	1,466,127
Children's (a)	2,140,091	318,593
Slippers, Leather—		
Men's	518,115	374,825
Women's	1,001,310	500,357
Children's	473,124	135,967

(a) Up to and including size 2.

The value of exports of Australian footwear has increased considerably since 1938-39, as is shown by the following table—

EXPORTS:	1938-39	1946-47	1947-48	1948-49	1949-50	1950-51
Wholly of leather	£18,931	£328,897	£208,834	£380,128	£110,878	£77,498
Part leather and fabric	(a)	9,528	1,757	113	32	2,838
Rubber	2,917	7,700	4,561	5,103	9,950	15,676
Other	1,103	80,594	12,689	1,143	13,252	2,722

(a) Included in "Other."

There has been, however, about a four-fold increase in the value of footwear imports dur-

ing 1938-39 and 1950-51. The value of imports in detail were—

IMPORTS:	1938-39	1948-49	1949-50	1950-51
Wholly leather—				
Men's	£19,020	£118,840	£79,157	£175,334
Women's and children's	54,814	401,147	372,757	621,408
Part leather and fabric—				
Ladies' evening footwear	5,480	5,772	1,924	108,587
Other	12,659	27,995	23,145	
Rubber footwear—				
Bath slippers	71	666	5,156	188,383
Goloshes and rubber sand shoes	3,896	132,709	118,675	
Gum and wading boots	609	98,932	184,336	355,448
Other footwear, including slippers, n.e.i., clogs and patterns	43,427	46,312	181,925	389,810

FOOTWEAR STOCK, ACCESSORIES AND FINDINGS

STOCK (or STUFF) CUTTING of soles, soling material and manufacture of toe puffs is sometimes carried out by tanners, by some footwear manufacturers, and also by specialist enterprises.

The manufacture of HEELS from leather or wood is a large and specialised part of the industry. INSOLES and SOCKS are also often

produced in the same factories. UPPERS, apart from those made in boot and shoe factories, are made by about eight manufacturers in Victoria and three in New South Wales; these firms specialise in clicking and sewing, and they give good service to many manufacturers unable to perform this work in their own factories. SOLE SEWING is another

branch of the trade in which a number of independent firms undertake this service for boot and shoe manufacturers and repairers. There are about eighteen specialist sole-sewers in Melbourne and about thirty-two in Sydney, in capacity ranging from a few machines to about half a dozen machines.

Boot and shoe FINDINGS, HEEL AND TOE TIPS are manufactured in Australia by a small number of medium-sized and large-sized firms; the production of these items is carried out by mass-production methods, and trading is competitive, although shortage of certain types of metal has restricted output.

PATTERN CUTTING is a specialised section of the boot and shoe industry, there being only three firms in Victoria and two in New South Wales, operating as independent units.

The manufacture of LASTS is carried on by a small number of specialised firms.

Although the greater part of demand for footwear stock, accessories and findings comes from the footwear manufacturers, that from footwear repairers is also significant.

Production of uppers, soles, heels and accessories in Australia in 1949-50 was—

PRODUCTION:	Manufactured in Boot and Shoe Factories	Manufactured in ALL Factories
	pairs	pairs
Uppers made for sale ..	167,439	167,439
Soles made for sale—		
Leather	2,965,941	7,171,875
Heels made for sale—		
Leather	1,735,422	3,779,624
Boot and shoe accessories (a)	£41,522	(a) £602,060

(a) Value only available.

REPAIR OF FOOTWEAR

Footwear repair establishments, widespread and commonplace in the cities and towns of Australia, are operating to the limit of available skilled labour, and are sometimes hindered by

shortages of sole leather. The value of output of repair establishments in 1948-49 was £1.91 million, and in 1949-50 was £2.07 million.

Part Three: Basic Statistics

COMPARATIVE STATISTICS, 1938-39/1949-50

NUMBER OF ESTABLISHMENTS AT 1938-39 AND 1949-50

NUMBER OF EMPLOYEES AT 1938-39, 1949-50, JUNE, 1950, SEPTEMBER, 1951

Activity (Statistical sub-classes used by Commonwealth Statistician, 1949-50)	Establishments		Employees			
	1938-39	1949-50	1938-39	1949-50	June 1950	Sept. 1951
	no.	no.	no.	no.	no.	no.
Tailored and Ready-made Clothing	1,177	1,902	26,499	37,250	(c)	(c)
Waterproof and Oil-skin Clothing (b) .. .	12	35	411	1,263	35,105	36,914
Furriers and Fur-dressing	138	129	1,386	926	878	817
Dressmaking and Hemstitching	(d)714	1,109	(d)12,475	18,899	16,334	16,668
Shirts, Collars, Underclothing (e) .. .	283	397	11,081	12,545	(c)	(c)14,991
Handkerchiefs, Ties and Scarves (f) .. .	42	66	1,501	1,496	13,444	(c)14,991
Hosiery and Other Knitted Goods (g) .. .	313	496	18,159	21,577	21,389	22,948
Foundation Garments (h)	20	59	2,070	3,086	3,469	3,624
Millinery	(d)155	204	(d)3,923	3,485	3,083	2,949
Artificial Flowers	12	18	430	376	420	367
Hats and Caps (j)	68	52	3,310	2,203	2,159	2,080
Gloves	8	56	76	1,145	(k)	(k)
Dyeworks and Cleaning (including Renovating and Repairing) (l)	140	656	3,138	9,364	8,040	7,831
Other (of Class VIII) (m)	35	55	807	626	(o)1,674	(o)1,564
Boots and Shoes (not Rubber)	311	(o)495	17,263	(o)23,110	(c)	(c)24,279
Boot and Shoe Accessories (p)	42	66	1,051	1,009	23,698	(c)24,279
Boot and Shoe Repairing	1,296	(o)1,451	2,283	(o)2,989	1,609	1,514
Totals (q)	4,766	7,246	105,863	141,349	131,302	136,546

STATISTICAL SUMMARY, 1949-50

EMPLOYMENT, MALE AND FEMALE

SALARIES AND WAGES PAID, IN TOTAL AND PER PERSON ENGAGED

VALUE OF PRODUCTION

VALUE OF MATERIALS, POWER, FUEL, REPAIRS, etc.

VALUE OF OUTPUT

See Explanations,
Appendix IV

Activity (Statistical Sub-classes used by Commonwealth Statistician, 1949-50)	Employment			Salaries and Wages Paid		Value of Pro- duction	Value of Materials, Fuel, etc., Used	Value of Output
	Males	Females	Persons	Total	Per Person Engaged			
Tailored and Ready-made Clothing	no. 8,419	no. 28,831	no. 37,250	£000 11,246	£ 302	£000 17,085	£000 20,391	£000 37,476
Waterproof and Oilskin Clothing (b) .. .	234	1,029	1,263	434	344	737	968	1,705
Furriers and Fur-dressing	463	463	926	324	350	561	582	1,143
Dressmaking and Hemstitching	1,875	17,024	18,899	5,248	278	8,174	7,453	15,627
Shirts, Collars, Underclothing (e) .. .	1,387	11,158	12,545	3,515	280	5,977	8,975	14,952
Handkerchiefs, Ties and Scarves (f) .. .	232	1,264	1,496	463	309	790	1,706	2,496
Hosiery and Other Knitted Goods (g) .. .	6,626	14,951	21,577	7,382	342	12,399	16,952	29,351
Foundation Garments (h)	337	2,749	3,086	990	321	1,778	1,998	3,776
Millinery	481	3,004	3,485	996	286	1,638	1,655	3,293
Artificial Flowers	56	320	376	88	234	155	93	248
Hats and Caps (j)	1,138	1,065	2,203	868	394	1,309	878	2,187
Gloves	252	893	1,145	337	294	507	444	951
Dyeworks and Cleaning (including Reno- vating and Repairing) (l)	4,792	4,572	9,364	3,173	338	5,413	1,309	6,722
Other (of Class VIII) (m)	117	509	626	178	284	324	283	607
Boots and Shoes (not Rubber) (o)	11,614	11,496	23,110	8,391	363	11,866	12,460	24,326
Boot and Shoe Accessories (p)	505	504	1,009	335	332	603	918	1,521
Boot and Shoe Repairing (o)	2,838	151	2,989	546	183	1,350	725	2,075
Totals (q)	41,366	99,983	141,349	44,514	315	70,666	77,790	148,456

Explanatory Footnotes to Both Tables

- (a) These employment figures are taken from monthly payroll-tax returns and differ slightly from the other employment figures, which are supplied on annual factory returns.
- (b) Also includes the proofing of fabric (with rubber, plastics, impregnating with chemicals, or otherwise) where carried on in direct conjunction with waterproof-garment manufacture.
- (c) Separate figures for each sub-class were not published.
- (d) Establishments in Tasmania classifiable within the sub-class "Millinery" were included in the sub-class then entitled "Dressmaking".
- (e) Also includes pyjamas; baby linen; manchester, napery, and whitework otherwise; embroidery and regalia; needlework. Does not include knitting.

- (f) Also includes braces; hose suspenders. Does not include knitting.
- (g) Includes knitted piecegoods.
- (h) Also includes suspender belts; surgical belts.
- (j) Also includes the making of hoods and capelines.
- (k) Separate figures were not published; they were included with sub-class "Other"—see footnote (m) below.
- (l) Does not include dyeworks engaged wholly or mainly on dyeing of textile yarns and piecegoods—see footnote (m), Part Three, Chapter 15, "Textiles, Felting, Cordage".
- (m) The sub-class "Other" is one of miscellaneous activities not elsewhere included in the Commonwealth Statistician's Class VIII, "Clothing (except Knitted)". The sub-class includes clothing repair (including invisible mending and re-weaving); fusion of collars; button covering; shoulder pads.
- (n) These figures also include employees for the sub-classes "Gloves" and "Umbrellas and Walking Sticks", because separate figures were not published.
- (o) Establishments in Tasmania classifiable within the sub-class "Boot and Shoe Repairing" were included in the sub-class "Boots and Shoes (not Rubber)".
- (p) Includes stuff (stock) cutting—soles, heels, toe puffs, stiffeners, platforms, socks, insoles, etc.; wooden lasts and heels.
- (q) Consideration and comparison of totals must take into account the effects stated in footnotes explaining the composition of certain sub-classes and figure units.

Chapter 17:

**PRODUCTS OF TEXTILES AND/OR
WASTES, CORDAGE, HAIR, FELT,
NOT ELSEWHERE INCLUDED**

Part One: Structure of Established Manufacturing Activities

THE manufacture (or making-up) of bedding, soft furnishings, candlewick-chenille, blinds, canvas goods, flags, bags and sacks, waddings and paddings, surgical dressings, sanitary pads, leathercloth, holland, linoleum, netting and nets made of cord or rope, of miscellaneous products based on textiles or textile wastes and treatment of textile wastes, are established in Australia as listed below, the extent of association of activities being shown by annotation. The listing is intended to be reasonably indicative, but not necessarily fully inclusive

BEDDING: There are about 140 establishments in Australia wholly or mainly engaged in bedding manufacture. The industry is sometimes associated with furniture making; mainly, however, mattresses of flock, imported kapok, and inner-springs with waddings and/or coir, are made by specialist companies. Within some of the factories, production of quilts, quilting, pillowcases and sleeping-bags is also undertaken. One firm so engaged is also concerned with production of chenille products within a branch factory. Most of the firms engaged are small. In 1948-49, only three establishments each employed more than 50 persons (one employed 196), and 28 each employed from 21 to 50 persons; these 31 establishments employed 1,268 persons out of the activity total of 2,074 persons.

SOFT FURNISHINGS, INTERIOR BLINDS, CARPET LAYING, LAMPSHADES: There are about 230 establishments wholly or mainly engaged in one or more of these activities. Sections of large departmental and furnishing stores in Australia produce items of furnishings within this group. Most of the establishments engaged are small, only six each employing more than 50 persons in 1948-49, and 21 each employing from 21 to 50 persons; these 27 establishments employed 1,093 persons out of the activity total of 2,454 persons. Included among establishments making interior blinds are those wholly or mainly engaged in assembling venetian blinds, with slats either of wood, metal, or plastics; about 30 establishments are so engaged, a few of which also make their own wood or metal slats.

CANVAS GOODS, TARPAULINS, SAILS, BUNTING AND FLAGS: There are about 130 establishments wholly or mainly engaged in one or more of these activities. Making up of the products is carried out by a few large manufacturers, many retailing manufacturers, and several small manufacturers specialising in certain types of products, such as sails, or exterior blinds and awnings. In 1948-49, only 6 establishments each employed more than 50 persons (one employed 133), and 14 each employed from 21 to 50 persons; these 20 establishments employed 858 persons out of the activity total of 1,523 persons.

BAGS AND SACKS (including printing): There are about 50 establishments wholly or mainly engaged in bag and sack production, including flour bags from imported calico; sugar bags and vegetable bags from imported hessian and jute piecegoods; and meat wraps from locally produced stockinette. Several of the companies make and print all types of bags; some are only concerned with production of a limited range, while a few of them are also concerned with making reinforced and multi-ply paper bags as a conjoined activity. Some of the companies trade in second-hand bags and repair them wherever necessary. Spiral tubing of hessian, for packaging, is made by one firm (which is also engaged in the combining of fabrics for shoe uppers—see later), under licence from an overseas manufacturer. In 1948-49, 2 establishments each employed from 51 to 100 persons, and 11 each from 21 to 50 persons; these 13 establishments employed 491 persons out of the activity total of 737 persons.

LINOLEUM: There is one manufacturer only (a branch company of a leading United Kingdom linoleum manufacturer) operating one establishment making plain, coloured, printed and marbled linoleum, and employing more than 400 persons.

ACTIVITIES concerned with the manufacture of products based on textiles and/or textile wastes, and not elsewhere covered in this study, are listed below, with, where known, the number (or an approximation) of manufacturers engaged in each activity. In official statistics the activities below, where carried on as a sole or major activity, are grouped together. Also included in that statistical grouping, where carried on as a sole or major activity, are textile dyeing, finishing and printing, manufacture of carpeting and carpets, felt and felt products, crocheted fabrics (including laundry-bag netting and bags), cords and braids, hair weaving, coir weaving, plastics coating of fabrics (other than nitrocellulose-coated fabrics), dressing of fabrics by filling, impregnating, calendering, pigmenting, etc.—activities covered in this survey elsewhere than below. The grouping also includes wig-making using human hair, there being about twenty establishments, all small, frequently also engaged in hairdressing; other hair-

dressers also trained as wigmakers will occasionally make wigs. There are about 120 establishments in this heterogeneous group of activities. In 1948-49, 5 establishments each employed more than 100 persons, and 12 each from 51 to 100 persons; these 17 establishments employed 1,783 persons out of 3,232 persons in activities included in the statistical grouping. The 22 establishments with 21 to 50 persons employed 764 persons, and the 31 establishments each employing less than 21 persons employed 685 persons.

CANDLEWICK-CHENILLE: There are five companies engaged in the manufacture of candlewick-chenille. The largest of these, which operates three branch factories, spins a portion of its cotton yarn requirements, and also weaves terry towelling. It has announced its intention of increasing its spinning capacity and has commenced to weave cotton cloth. (Imported grey cloth is mainly used as the base material for Australian-made chenille.) One other company, with two branch factories, twists or doubles cotton yarn, but does not spin. All of the companies make up the whole of their output into furnishings and garments. (Companies engaged in the making-up of chenille garments, but not tufting of the material, are included among clothing manufacturers.)

PLASTIC-COATED FABRICS (nitrocellulose, polyvinyl-chloride (P.V.C.), polyvinyl-butyral (P.V.B) coating): There are nine manufacturers of these products in Australia. Nitrocellulose "leathercloth" is made only at two establishments; one is a large establishment, employing more than 200 persons, makes nitrocellulose paste; for its own use and for the other manufacturer, and is also engaged in rubber and P.V.C. coating of fabrics (this establishment is operated by the leading chemicals and explosives manufacturer in Australia); the other establishment is small, operated by a company principally engaged in tanning of chrome leathers, and obtains its nitrocellulose pastes from the other manufacturer of nitrocellulose leathercloth. Seven other manufacturers coat fabrics with plastics, mainly P.V.C. Three of these are engaged principally in the plastics products industry and also make unsupported P.V.C. film. Two of the others also make unsupported P.V.C. film; one, a subsidiary of Felt and Textiles of Australia Ltd. (see also page 404), with two establishments, is the only firm in Australia which coats felt with P.V.C.; it is also engaged in the extrusion of P.V.C. into products such as shoe randings, motor-vehicle fender-pipings, upholstery pipings and electrical tubing. Of the remaining two manufacturers, one is a specialist in fabric coating, filling (holland), pigmenting, and rot-proofing (with two factories), and the other is a specialist in P.V.B. coating for shoe bias binding (see also Chapter 7). Chemical-proofing of fabric for water-proof garments is mainly done by certain manufacturers of waterproof garments (see Chapter 16).

DRESSING (FILLING, IMPREGNATING, PIGMENTING) AND COMBINING OF FABRICS: One company, with two establishments, is engaged in starch-filling and glazing of fabrics for hollands and bookcloths, and pigmenting of canvas and duck for striped canvas goods, and of cloth for bias bindings, slippers, etc. This company also coats fabric with polyvinyl-butyral, and rot-proofs and fire-proofs flax and cotton canvas and duck, and hessian upholstery webbing. One company, a subsidiary of Felt and Textiles of Australia Ltd. (see also page 404), with two establishments (which is also referred to in "Plastic-Coated Fabrics", above) is engaged in the filling and impregnating and calendering, where required, of fabrics, and is the only Australian manufacturer of buckram. One firm is engaged principally in the combining of fabrics for shoe and slipper uppers; principal materials combined are gabardine to cotton duck, satin to duck or calico, knitted rayon to hessian, and sometimes felt is used as the backing; some of the combined materials are also embossed. (This firm also manufactures spiral tubing of hessian for packaging (see also "Bags and Sacks"); some footwear trimmings and quilted fabrics, and pre-built borders for inner-spring mattresses.)

SURGICAL DRESSINGS AND MEDICAL PLASTERS: There are two companies which make-up from, principally, imported gauze, lint, calico, flannelette and plaster base-cloth. One of the companies (the leading manufacturer of surgical dressings in Australia, and an associate company of a leading U.S.A. company of the same name) also produces surgical cotton wool from the raw fibre stage. A third company makes a specific patented type of bandage which adheres only to itself, not to the skin (and is therefore not a plaster); the gauze is imported, treated with adhesive by trade coaters, and slit and packaged by this firm.

COTTONWOOL AND CELLULOSE WADDINGS AND PADDINGS: Imported linters and low-grade lint are used to produce surgical cotton wool. Two companies make surgical cotton-wool; one of these (see preceding activity) is the leading manufacturer in Australia of surgical dressings, and of absorbent/soluble (cellulose wadding) sanitary products, but does not make industrial waddings; this company also makes non-absorbent neck wool for stopping bottles. The other company, with two establishments, as well as making surgical and industrial waddings, also makes absorbent/soluble sanitary products, and is a large maker of motor-body upholstery pads (the company is an associate company of Felt and Textiles of Australia Ltd.—see also page 406). Two other companies make sanitary pads; one, owned by U.S.A. interests, also makes cleansing tissues; the other is a subsidiary of a large hosiery company, and is the only one manufacturing from fillings obtained from Australian sources.

TEXTILE WASTES PROCESSING AND PRODUCTS THEREFROM: About 30 firms carry out ragging and garnetting of mill and textile wastes; most of these also make flock, and a few supply shoddy and mungo blends, when required. A few wastes processors also produce waddings and paddings for motor-vehicle bodybuilding, and for upholstery, bedding, tailoring,

and other uses. The principal processor of textile wastes and manufacturer of products therefrom is the Felt and Textiles group (see also page 405), which has 4 subsidiaries (operating 5 establishments) engaged in this activity; three of these are principally engaged in the breaking down of textile wastes and manufacture of flock; the other, operating two establishments, makes flock, mungo and shoddy blends, and is the principal Australian manufacturer of glazed and unglazed paddings for motor-car upholstery, mattresses, bedding, handbags, quilting, etc. (it also makes needled jute/hair underfelt and insulating felt), and trades in unprocessed fibre and textile wastes.

FELT PROCESSING: One company, with two establishments, a subsidiary of Felt and Textiles of Australia Ltd. (see also page 404), is engaged in the cutting and slitting of plain and processed felt for a wide variety of industrial and domestic products, combining of plain and processed felt and/or fabrics, treating and forming of felt for motor bodywork trimmings, rubber coating of felt, etc. (this company also coats felt with P.V.C., and, at one establishment, makes buckram—see earlier). One other company, principally a felt manufacturer, also makes cut, laminated, formed, etc., components from industrial felt (see also "Felting", Chapter 15). Cutting, stencilling and combining of felt and/or fabrics, for the clothing and other trades, are also carried out by a number of smaller firms.

NEEDED FELTS: About nine firms make needled jute/hair soft felt for floor-covering underfelt, and for insulation and padding. The principal manufacturer, Felt and Textiles of Australia Ltd., makes needled felt at four of its establishments. That company, and two others of the nine, also make wool felts, including flooring felts. (See also "Wool Felt", Chapter 15.)

NETTING AND NETS, for sports, fishing, industrial use: Several establishments are solely or mainly engaged in making netting and nets. The netting used for sports-nets is mainly hand-made by outworkers to finished size, that for fish-nets is practically all made from imported machine-made netting. Many fishermen make up their own nets. Cargo and industrial nets made of rope are made principally by the employees of the users of such nets. One company engaged in making sports-nets and laundry-bags has installed a power-net machine (the first power-net machine installed in Australia) for manufacture of netting for sports-nets and possibly heavy fish-nets. An established manufacturing company, owned by a leading United Kingdom manufacturer of sewing threads and fish netting, has also recently installed a power-net machine for the manufacture of fish netting.

MISCELLANEOUS ACTIVITIES: Manufacture of products such as felt badges and pennants, dusters, woolled-sheepskin products (including powder-puffs and mats), artificial hair, dolls' wigs, movie screens, parachutes, etc., is carried on as the sole or major activity in several small establishments each employing a few persons.

Part Two: Outline of Capacity of Manufacturing Activities

BEDDING AND MATTRESSES

The manufacture of blankets, sheets, pillowslips, pillows, quilts, bedspreads and mattresses, etc., in Australia is a substantial industry supplying practically all of the local market requirements.

One large Australian cotton-weaving firm weaves sheeting and pillow cloth and also makes up SHEETS and PILLOWSLIPS (see "Cotton", Chapter 15); at capacity levels of production, this firm would meet about 20 per cent. of Australian requirements. The major part of Australian requirements of sheets and pillowslips, however, are made up in Australia from imported cloth. Many housewives do their own making up of sheets and pillowcases. Imports of made-up sheets, counterpanes and bedspreads into Australia in 1949-50 were valued at £123,025; and of pillow and bolster covers, etc., £7,667; most of these imports came from the United Kingdom.

Capacity for production of BLANKETS is more than sufficient to meet local requirements, and to permit some export. Information on production, imports and exports is given in the "Wool" section, Chapter 15.

Output of QUILTS in Australia in 1949-50 totalled 93,737, valued at £346,580. (The manufacture in Australia of candlewick bedspreads is discussed in the section "Candlewick-Chenille", this chapter.) Imports of quilts, mostly

marcella, honeycomb, alhambra, grecian and dimity, in 1948-49 were valued at £193,000 and in 1949-50 at £233,000. These imports came mainly from the United Kingdom.

All of the MATTRESSES required by the Australian market are made in Australia. Production in 1948-49, 1949-50 and 1950-51 was—

PRODUCTION:	1948-49	1949-50	1950-51
	'000	'000	'000
Spring (woven wire and link mesh) mattresses	202	215.7	275.2
Inner-spring mattresses	147	204.4	294.7
Soft-filled and other mattresses	420	296.7	502.7

(See Chapter 8, "Rubber Products", for comment on manufacture of rubber mattresses in Australia.)

Most of the piecegoods used to cover quilts and mattresses are imported into Australia. The springs for inner-spring mattresses, and waddings and paddings, are of Australian manufacture, but all kapok used for stuffing mattresses is imported. In 1948-49, 3.7 million lbs., and in 1949-50, 3.5 million lbs., of kapok were imported from Ceylon, India and Indonesia. To date, requirements of mattress and pillow ticking have been imported, but a firm has recently been established with capacity for weaving ticking.

SOFT FURNISHINGS, INDOOR BLINDS, LAMPSHADES, CARPET LAYING

The making-up of curtains, drapes, loose covers for furniture, dressing-table "skirts", and similar articles of FURNISHING DRAPERY, is mostly a "to order" trade, done to customers' individual requirements. Many large furniture stores and retail stores selling furniture and furnishings have workrooms for making up those articles. Many housewives do their own making up. The laying of carpeting is also an activity mainly carried on by furniture and departmental stores and by carpet warehouses.

INDOOR BLINDS AND AWNINGS are made by firms specialising mainly in the manufacture of blinds and also by canvas-goods manufacturers. VENETIAN BLINDS are mainly made by specialist blind manufacturers. Total

output of indoor blinds, etc., in 1949-50 was as follows—

PRODUCTION:	1949-50
Venetian blinds—	£
Wooden	496,742
Metal	344,453
Indoor blinds and awnings	434,582 (a)

(a) Of this total, £318,375 were made by blind manufacturers, and £116,207 by canvas-goods manufacturers

In addition to the above, manufacturers of blinds made outdoor blinds and awnings to the value of £158,583. Imports of curtains and blinds of textile material in 1949-50 were valued at £35,519. Most of these imports came from the United Kingdom. Exports were small.

CANVAS-GOODS MANUFACTURE

The canvas-goods manufacturers in Australia make a very wide range of articles and supply practically all of the needs of the Australian market. The value of output of some of the principal items manufactured in 1949-50 was—

PRODUCTION:	1949-50
	£
Waterproofed piecegoods	169,462
Water bags	73,355
Tarpaulins	601,086
Tents, flies, marquees	552,271
Sails	74,564

Outdoor blinds and awnings	219,551 (a)
Motor covers	58,739
Horse and cow rugs	72,022 (b)

(a) Outdoor blinds and awnings to the value of £158,583 were also made by blind manufacturers.

(b) Horse and cow rugs valued at £29,913 were also made by saddlery and harness manufacturers.

Canvas-goods manufacturers also made indoor blinds and awnings (see above) to the value of £116,207 in 1949-50.

Imports of made-up canvas goods are practically confined to items which are integral parts of machinery or other equipment. No statis-

BAGS AND SACKS

In 1949-50, Australia produced 218 million bushels of wheat and 1,110 million lbs. of greasy wool. Bulk handling of wheat is not as widely practised in Australia as in other large producing countries; the larger part of the crop is bagged. The wool clip requires large numbers of woolpacks. Most of these requirements have to be imported.

The bag and sack industry in Australia makes calico bags, meat wraps, and jute and hessian bags and sacks in smaller sizes (up to about 140 lb. sugar and flour bags). Large-sized jute bags, corn sacks, woolpacks, bran sacks, etc., are made in India in very large quantities in long production runs, and landed prices of such bags imported into Australia are so low that manufacturers here could not compete.

Bagging made of woven paper-yarn has been tried, but is reported to have been unfavourably received by the bagmakers because it does not make up easily, and by the customers because it has not the durability of hessian.

SPIRAL TUBING of hessian, for packaging, is made by one firm, under licence from an overseas manufacturer. No statistics of production, imports or exports are available.

Australian production of bags and sacks, in 1949-50, was as follows—

PRODUCTION:	1949-50
	doz.
Flour bags (calico)	668,194
Meat wraps	367,974
Sugar bags	100,247
Other hessian bags	611,670
Other bags	214,711

Capacity is considerably higher than present production levels. All printing of bags is done within the industry.

LINOLEUM

LINOLEUM is made in Australia by one company which is associated with one of the largest United Kingdom linoleum manufacturers. It makes plain, coloured, printed and marbled inlaid linoleum. Wood and cork flour required to make its linoleum is ground by the company, which has also supplied this material to other users. Paint requirements are also made in the same factory.

Output of linoleum by the Australian manufacturer is much less than the demand, and considerable quantities of linoleum are imported. The Australian company is expanding its activities and plans to double its present

IMPORTS:	1948-49	1949-50
	mill.sq.yds.	£
Felt-base floor coverings	4.26	498,972
Plain linoleums (or similar floor coverings, but not with felt base)	0.25	83,621
Linoleums other than plain, including inlaid	7.57	2,209,488
Totals	12.08	£2,792,081

Although demand has fallen considerably in recent months, in view of the high level of imports, there seems scope for further expan-

tics are available. There is little export of canvas goods.

The MEAT WRAPS are practically all made from imported hessian or from stockinette knitted in Australia. (Some of the knitting firms also make up the meat wraps.)

All of the calico, hessian and jute piecegoods used in making bags are imported. Imports in 1948-49 of such piecegoods were: Calico, 2 million sq. yds., jute and hessian piecegoods, 43.2 million sq. yds. (practically all from India). In 1949-50, imports of calico for bag making were 5 million sq. yds. and of jute and hessian 33.5 million sq. yds. The manufacture of jute and hessian piecegoods in Australia is considered uneconomic because of inability to compete against Indian manufactures, although one small firm has recently commenced manufacture (see Chapter 15).

Imports of bags and sacks in 1948-49 and 1949-50 (practically all from India) were—

IMPORTS:	1948-49	1949-50
	'000 doz.	'000 doz.
Bran, chaff and compressed fodder	316.4	47.8
Corn and flour	6,342.5	6,560.0
Gunny, potato, onion and coal	34.9	25.7
Ore	1.3	1.0
Sugar mats and sacks	133.4	4.3
Woolpacks	259.3	373.1

Exports of Australian-made bags and sacks in 1948-49 totalled 60,352 dozen, of which 37,600 dozen were secondhand; and in 1949-50 about 43,562 dozen, of which 26,440 dozen were secondhand. The price of bags and sacks has increased tremendously in the last few years, causing a considerable increase in the demand for secondhand bags.

(See Chapter 5, "Paper Products, Printing, Signwriting, Photographic Materials", for comment on manufacture of paper bags and sacks in Australia.)

capacity. No account of the company's yearly output of linoleum is published.

FELT-BASE floor-covering is not made in Australia.

From 1935 to 1939 Australia was the United Kingdom's best customer for linoleum and felt-base for floor coverings, and took an annual average of 27 per cent. of total United Kingdom exports. Over that period, Australia's average annual imports were 8.3 million sq. yds. In 1948-49 and 1949-50 imports of linoleum and other floor coverings with a surface similar to linoleum were—

	1948-49	1949-50
	mill.sq.yds.	£
Felt-base floor coverings	4.26	498,972
Plain linoleums (or similar floor coverings, but not with felt base)	0.25	83,621
Linoleums other than plain, including inlaid	7.57	2,209,488
Totals	12.08	£2,792,081

sion of the industry in Australia beyond that being planned. Imports are now, however, subject to licence—see Appendix II.

CANDLEWICK-CHENILLE

The principal products of the candlewick-chenille industry are BEDSPREADS, BATH MATS, RUGS, HOUSE AND BEACH COATS, CURTAINS. Imported grey cloth is used as the base cloth and coarse-count cotton yarns for the raised or tufted design. Some candlewick manufacturers dye their own yarn and/or piecegoods. Cotton yarns of local manufacture are mainly used. One candlewick manufacturer spins its own cotton yarn; this firm, already weaving terry towels, also weaves cotton cloth.

No statistics of Australian production of candlewick articles are available, nor are any imports or exports specified. Australian manufacturers were short of trained labour for a great part of the post-war period, but have now (early 1952) caught up with demand, have put off workers, and thus have idle capacity. Some products are exported, in limited quantities. The largest Australian firm has capacity which is reputed to make it the largest producer of candlewick-chenille in the world.

FABRIC COATING, IMPREGNATING, FILLING AND PIGMENTING

The waterproofing of fabrics by coating with a rubber solution has been done in Australia for many years, principally by firms engaged in the manufacture of rubber products. (See also Chapter 8.) Some firms mainly engaged in the manufacture of waterproofed clothing also coat and/or impregnate fabrics with rubber, rubber mixtures and chemical compounds. The recent trend has been towards a preference for chemically-treated waterproofed cloths rather than the former rubber-coated cloths for rainwear, except for such items as sailors' heavy "oilskins", etc. (See also Chapter 16.)

The manufacture of leathercloth (a fabric coated with nitrocellulose) was commenced in Australia in the mid-1930's; this is mainly used for upholstery, particularly car upholstery, bookbinding, baby carriages and prams, etc.

Since about 1945 the coating of fabrics with polyvinyl-chloride and polyvinyl-butyral has

rapidly developed; for many uses, fabrics coated with polyvinyl plastics are replacing the older nitrocellulose-coated fabrics. (See also Chapter 7.)

Further (mainly recently developed) activities in this general field include the pigmenting of canvas and duck for striped outdoor blinds and awnings, deckchair covers, sunroom furniture, etc., the filling of open-weave fabric for buckram and the filling of fabrics for blind holland; at least one of these firms also does commission rot-, sun- and weather-proofing of fabrics. Some proofing of cloth (mainly canvas and duck) is done by cotton mills and some by canvas-goods manufacturers. (See also Cotton, Chapter 15; and Canvas Goods, above.)

Considerable quantities of coated, impregnated, etc., cloths are still imported into Australia, principally from the United Kingdom. In 1948-49 and 1949-50, imports were—

	1948-49		1949-50	
	sq. yds.	£	sq. yds.	£
Bookbinding cloth, prepared with nitrocellulose	21,807	2,367	20,592	4,609
Leathercloth	862,007	218,983	997,975	291,780
Leathercloth binding	—	1,800	—	932
Oil baize and similar fabrics	1,693,976	225,484	1,035,652	136,981
Waterproofed cloth, prepared with rubber, oil, celluloid or nitrocellulose—				
Wool or chiefly of wool	14,780	2,545	10,291	7,052
Cotton or chiefly of cotton	1,002,377	209,215	871,342	189,992
Silk or chiefly of silk	30,386	10,884	7,857	2,172
Rayon or other synthetics	19,701	5,929	40,019	9,778
Other	128,908	25,969	267,494	57,876
Canvas and duck, waterproofed by treatment with any substance	93,797	29,901	388,178	135,299
Waterproofed tape and textile strip, prepared by treatment with any substance	—	138,203	—	136,371
Starch-filled bookbinding cloth	1,122,531	131,366	804,474	90,542

SURGICAL DRESSINGS, PLASTERS, SANITARY TISSUES, Etc.

Manufacturers in this field produce SURGICAL BANDAGES, COTTONWOOL, DRESSINGS, PLASTERS, etc., and sanitary products such as FACE AND CLEANING TISSUES, SOLUBLE SANITARY PADS and TAMPONS, etc. Australian productive capacity for these products is, generally, sufficient to meet local requirements. No figures of Australian output are available.

Most of the materials used by Australian manufacturers are imported. No gauze is manufactured in Australia, though small quantities were made during the 1939-45 War. Soluble cellulose-wadding, for sanitary products, is all imported; the quantity imported in 1949-50 was 969,000 lbs., valued at £42,380,

the sources being mainly Sweden, U.S.A. and Norway. The base cloth for plasters and lint cloth, which has to be a special type of extra pure cloth without filling or loading and which is made from best-quality Egyptian cotton, is supplied mainly by the United Kingdom. Most of the cotton linters and low-grade lint used for cottonwool manufacture is imported.

Appreciable amounts of surgical dressings, bandages, plasters, etc., were imported in 1949-50, the values being—

	1949-50
Surgical dressings	£118,209
Lint, gauzes, bandages	646,052
Plasters, medicated or unmedicated	87,461
Absorbent cottonwool, unmedicated	17,182

TEXTILE WASTES PROCESSING AND PRODUCTS THEREFROM

The treating of textile wastes—tailors' cuttings, whitework clippings, old clothes and waste piecegoods, felt cuttings, spinners' waste, etc.—to produce FLOCK, is done in Australia by a number of medium-sized to small-sized firms. Some flock makers segregate wool wastes to make a pure-wool flock used in making quilts, mattresses, etc.; or to be re-spun into shoddy woollen yarn. Flock may be used, as such, for stuffing mattresses and pillows, as engineers' waste, etc., or further processed to make GARNETTED FLOCK, which is used as padding for inner-spring mattresses, for upholstery, for the manufacture of industrial waddings and paddings, upholstery pads, etc. Some waste material is exported. In 1949-50 exports of manufactured waste and waste fabrics were 140,150 lbs. Exports of rags and clippings in that year totalled 12,940 cwt. One firm specialises in the dyeing of waste material for export.

No figures of production of flock from waste materials are available, but output is not sufficient to meet all Australian requirements. Im-

ports of manufactured wastes and waste fabrics in 1949-50 totalled 962,000 lbs. The deficiency of Australian production arises partly from the lack of sufficient waste material to treat. In 1949-50 about 1,600 cwt. of rags and clippings of all kinds were imported.

INDUSTRIAL WADDINGS AND PADDINGS, which are used for upholstery (furniture, and motor car), in inner-spring mattresses, by the clothing trade (shoulder pads, etc.) and in the manufacture of hand and travel bags, are made from flock produced by wastes processors, and from carding and spinning waste, combings, sweeps, etc. In some cases jute is mixed with the other fibres, particularly for tailors' waddings. Both glazed and unglazed waddings are made in Australia, as well as upholstery pads, used particularly for motor-car upholstery and for inner-spring mattresses.

No production figures are available. Imports of waddings and cottonwool (non-medicated, non-absorbent) in 1949-50 totalled about 760,000 lbs. (Separate figures are not published.)

FELT PROCESSING

The processing of felt, by cutting, slitting, treating, forming, combining, etc., to make a wide range of domestic and industrial products, is well established and provides most of the requirements of Australian users. No

production figures are available. Imports of articles of felt, including materials cut into shape therefor, in 1949-50 were valued at £20,842. Australian exports were valued at £3,304.

NEEDED FELTS

The production of needled JUTE/HAIR felts, for undercarpeting and insulating, is sufficient to supply most of Australian requirements. No figures of Australian output are available, but production is thought to be substantial. Imports of felts other than wool felts

in 1949-50 totalled 32,183 square yards, valued at £19,689; and exports were 6,759 square yards, valued at £6,453.

(For comment on hair processing other than for carpet underfelt, see "Furniture", Chapter 3.)

NETTING AND NETS

Production of SPORTS NETS has kept pace with demand, and is capable of expansion without undue difficulty. Seasonal shortages of various types of sports nets sometimes occur, mainly because of a shortage of skilled labour, as practically all netting used for sports nets in Australia is hand netted. The installation of a power-net machine in 1950 by one of the principal manufacturers of sports nets in Australia, should remove for some years the shortages of sports netting. Netting twine is made in Australia in adequate supply; usually flax twine, made from Australian-grown flax, is used. All other materials required are also made in Australia.

Small articles such as RABBIT NETS and STRING-BAGS, and ROPE QUOITS (not infrequently made by or for the sports-nets makers), appear to be in adequate supply, and are mostly Australian made. HAIRNETS are not made in Australia; imports of hairnets of natural or imitation hair in 1948-49 were valued at £57,300, and in 1949-50 at £87,500.

FISH NETS of varied types, including, recently, a small purse-seine type, are made as required, not infrequently by the user. NETTING for fish nets is not made in Australia other than oddments such as cod-pieces made

by hand. The quantity imported is not recorded, but value of imports are indicative of the large and increasing demand—

IMPORTS:

	£
Average yearly imports (a) for the five years 1934-35 to 1938-39	23,146
1945-46	112,818
1946-47	84,772
1947-48	99,121
1948-49	141,336
1949-50	121,249
Average yearly imports (a) for the five years 1945-46 to 1949-50	111,859

(a) The imports up to and including 1948-49 include nets, and also netting for rabbit nets and other purposes; for 1948-49 and onwards the imports are for nets and netting for fishing. Imports in 1948-49 of nets and netting for rabbiting were valued at £695, and in 1949-50 at £2,471.

In the post-war years most of the netting and nets imported into Australia came from the United Kingdom; in the five-year period immediately prior to the 1939-45 War, however, 22 per cent. by value of netting imported into Australia was from Japan, despite a 15 per cent. duty as compared to free entry for netting from the U.K.

The variety of mesh size and plys of netting required in Australia is considerable, whereas quantities are not so considerable in many of the sizes. However, a leading U.K. manufacturer of fish netting (and owned by the largest company manufacturing linen thread in the U.K.) has recently installed a power-net machine at the factory of a cordage manufacturer owned by the U.K. interests.

The manufacture of fish netting in Australia will help to make Australia independent of overseas supplies; many difficulties were experienced by the fishing industry throughout the 1939-45 War and early post-war years because of a serious shortage of netting, the distribution of which had to be strictly controlled.

MISCELLANEOUS ACTIVITIES

The manufacture in Australia of a large number of small miscellaneous items such as felt pennants and badges, dusters, powder puffs, dolls' wigs, pipe cleaners and such oddments is carried on as a sole or major activity by nume-

rous small firms. In general, as small oddments and scraps of materials may be used for manufacture, little difficulty would be found in maintaining production to meet demands.

Part Three: Basic Statistics

COMPARATIVE STATISTICS, 1938-39/1949-50

NUMBER OF ESTABLISHMENTS AT 1938-39 AND 1949-50

NUMBER OF EMPLOYEES AT 1938-39, 1949-50, JUNE 1950, SEPTEMBER 1951

Activity (Statistical Sub-classes used by Commonwealth Statistician, 1949-50)	Establishments		Employees			
	1938-39	1949-50	1938-39	1949-50	June 1950 (a)	Sept. 1951 (a)
	no.	no.	no.	no.	no.	no.
Bedding and Mattresses (not Wire) (b)	116	151	1,784	2,222	2,079	1,892
Furnishing Drapery (c)	83	128	1,217	1,748	(e)2,514	(e)2,490
Blinds (d)	39	123	406	957		
Canvas Goods, Tents, Tarpaulins, etc. (f)	73	128	957	1,510		
Bags and Sacks (g)	47	52	887	792	743	844
Linoleum, Leathercloth, Oilcloth, etc. }	(h)	(j)4	(h)	746	815	(k)750
Bone, Horn, Ivory and Shell						
Other (of Class VI) (l)	(m)	(m)	(m)	(m)	(m)	(m)
Totals (n)	358	586	5,281	7,975	7,488	(k)7,384

STATISTICAL SUMMARY, 1949-50

EMPLOYMENT, MALE AND FEMALE

SALARIES AND WAGES PAID, IN TOTAL AND PER PERSON ENGAGED

VALUE OF PRODUCTION

VALUE OF MATERIALS, POWER, FUEL, REPAIRS, etc. }

See Explanations,
Appendix IV

VALUE OF OUTPUT

Activity (Statistical Sub-classes used by Commonwealth Statistician, 1949-50)	Employment			Salaries and Wages Paid		Value of Pro- duction	Value of Materials, Fuel, etc. Used	Value of Output
	Males	Females	Persons	Total	Per Person Engaged			
	no.	no.	no.	£'000	£	£'000	£'000	£'000
Bedding and Mattresses (not Wire) (b)	1,435	787	2,222	843	379	1,888	3,474	5,362
Furnishing Drapery (c)	551	1,197	1,748	534	305	871	992	1,863
Blinds (d)	756	201	957	315	329	648	769	1,417
Canvas Goods, Tents, Tarpaulins, etc. (f)	849	661	1,510	543	360	1,021	2,338	3,359
Bags and Sacks (g)	424	368	792	266	336	627	2,089	2,716
Linoleum, Leathercloth, Oilcloth, etc. (j) }	652	94	746	363	487	785	1,423	2,208
Bone, Horn, Ivory and Shell								
Other (of Class VI) (l)	(m)	(m)	(m)	(m)	(m)	(m)	(m)	(m)
Totals (n)	4,667	3,308	7,975	2,864	359	5,840	11,085	16,925

Explanatory Footnotes to Both Tables

- (a) These employment figures are taken from monthly payroll-tax returns, and differ slightly from the other employment figures, which are supplied on annual factory returns.
- (b) Includes the manufacture of flock where carried on as an integral part of bedding manufacture, but as the lesser activity.
- (c) Also includes carpet sewing and laying; and lampshades.
- (d) The sub-class mainly applies to makers of interior blinds, but also includes outdoor blinds and awnings of canvas where the sole or major activity.
- (e) Separate figures for each sub-class were not published.
- (f) Also includes motor-car trimmings; and loose covers. Includes outdoor blinds and awnings of canvas where made as a lesser activity by a canvas-goods manufacturer.
- (g) Also includes meat wraps.
- (h) At 1938-39, separate figures for "Linoleum, Leathercloth, Oilcloth, etc." were not published, but were grouped into one set of figures with two other sub-classes then entitled "Bone, Horn, Ivory and Tortoiseshell" and "Celluloid and Similar Compositions".
- (j) Linoleum is made at one establishment only. The "leathercloth" applies only to nitrocellulose-coated fabrics which are made at two establishments only. Oilcloth is not made in Australia.
- (k) Estimate only. The published figures comprise in one the three sub-classes "Linoleum, Leathercloth, Oilcloth, etc.", "Plastics Moulding and Products" and "Bone, Horn, Ivory and Shell". See also Part Three, Chapter 7, "Plastics Products".
- (l) The sub-class "Other" is one of miscellaneous activities not elsewhere included in the Commonwealth Statistician's Class VI, "Textiles and Textile Goods (not Dress)". The sub-class includes carpeting and carpets; felt and felt products; crocheted fabrics and laundry-bags; textiles dyeing, printing, finishing, shrink and rot proofing; cords and braid; hair weaving; coir weaving; plastics coating of fabrics; dressing of fabrics, by filling, impregnating, calendering, pigmenting, etc.; candlewick-chenille tufting and associated making-up of candlewick products and garments; surgical dressings and medical plasters; waddings and paddings; textile-wastes treatment; netting and nets for sports, fishing and

industrial use; wigmaking; miscellaneous products such as felt badges and pennants, dusters, woolled sheepskin products (including powder puffs, mats), artificial hair, dolls' wigs, movie-screens, parachutes

- (m) Statistics of the sub-class "Other" are included in this study in Chapter 15, "Textiles, Felting, Cordage" (see Part Three), as the greater part of employment within the sub-class appears to be in activities dealt with in that chapter—carpeting; felt; textiles dyeing and finishing; crocheted fabrics; hair weaving; and coir weaving. The remaining activities of the sub-class are dealt with in this Chapter, "Products of Textiles and/or Wastes, Cordage, Hair, Felt, Not Elsewhere Included".
- (n) Consideration and comparison of totals must take into account the effects stated in footnotes explaining the composition of certain sub-classes and figure units.

Appendix I:

**SERVICES TO THE AUSTRALIAN
MANUFACTURING ECONOMY**

Services to the Australian Manufacturing Economy

THE Australian economy includes a full range of services—industrial, commercial, technical, professional—common in a highly developed modern society. An indication of the general nature of these services is given hereunder.

DISTRIBUTION

Wholesale

Wholesale trade in Australia is well developed, and lies almost entirely in the hands of private enterprise. As Australia has, until relatively recent times, been largely dependent upon imports for the greater part of her capital goods and many of her consumer goods, wholesale houses have been very closely linked with importing. Similarly, export trade, which has in the past largely consisted of primary products and raw materials (wool and wheat being of first importance) has been handled by large exporting agencies; many firms in both categories have overseas connections. Since the 1914-18 War, however, an increasing quantity of primary produce (wool being a notable exception) has been handled initially by official marketing agencies, set up under State or Commonwealth statutory authority, which acquire the whole, or a substantial part, of the output of a given commodity, and arrange for its distribution through ordinary trade channels. These marketing schemes are generally an integral part of the policy of the various Governments to ensure a regular guaranteed return to the primary producer, in a country where seasonal conditions vary considerably, and world prices are often uncertain.

Retail

Retail trade in Australia is also predominantly in the hands of private enterprise. The co-operative movement, although it has been established in Australia for a considerable time, has achieved only limited success, and is not at present showing any rapid development. Its main achievements in the retail field have been in mining communities which are individual in character and mostly remote from the capital cities. However, some primary producers' retail co-operatives have been very successful.

Distinct differences can be observed between city and country retail practices. There are few large centres of population in Australia outside the State capitals. In small centres the general store, supplying all the regular needs of a rural community has been predominant, and has played a very important part in the rural economy, as most country stores extend

substantial credit to farmers whose income is usually derived from an annual crop.

In the cities, the growth of large departmental stores has been an important feature over the last fifty years. In each large city there are a number of such stores, which in size and in range of commodities compare with similar organisations elsewhere in the world. Not many of these stores carry on business in more than one centre, and few of them have branches in the suburban areas of the cities in which they operate. Some of them, however, conduct a substantial mail-order business with rural customers, supplying them with many items which would not be obtainable in country stores. There are also a limited number of specialist mail-order houses.

Since the 1914-18 War there has been a substantial growth of "cash and carry" establishments of the type colloquially known in the United States as the "Five and Ten Cent Store" and these have established "chains" of shops not only in city and suburban areas, but in many country towns.

In the cities, the greater part of retail distribution, particularly in the realm of foodstuffs and similar consumable goods in regular demand, is carried on in small suburban establishments, the majority of which are "one-man" businesses. A substantial number of chain stores, however, are found in this field, particularly in groceries, meat, bread and cakes, and pharmaceuticals. Self-service stores are found in many suburban and town shopping areas, and are probably increasing in number. The first store of the "supermarket" type, now becoming general in cities and towns of the U.S.A., was recently established in Australia, at Sydney.

A number of larger establishments, both wholesale and retail, also manufacture some of the lines they sell. On the other hand, there are a number of manufacturers in various fields who either sell their goods direct to the consumer, or maintain their own distribution agencies. Some of these have been noted individually in the body of this study; agricultural equipment, machinery, pharmaceuticals, furniture and footwear may be cited as examples.

TRANSPORT

All forms of transport are highly developed in Australia. The 1939-45 War, however, placed a great strain on the Australian transport system from which it has not yet recovered. Major efforts are being made to improve services, in spite of difficulties in obtaining the necessary capital equipment and materials.

Railways

Railways have been, and remain, the most important branch of the Australian transport system, and the carriage of basic commodities and the more important primary produce is still largely dependent upon them. Apart from a few insignificant exceptions, the rail-

ways of Australia are governmentally owned, each State maintaining its own network, while three important lines are under the control of the Commonwealth. Unfortunately the different States adopted different gauges in the past, and the value of the railways as a national entity is much reduced thereby. In 1944, the Commonwealth Government adopted the general principle of unification of gauges, and an initial plan to this end was drawn up. However, although certain sections may be undertaken in the near future, the current shortages of finance and some materials will certainly prevent the complete scheme from being carried out for many years to come. In the two largest State capitals, Sydney and Melbourne, extensive electrified suburban railway systems are in operation, and the two capitals next in size, Brisbane and Adelaide, have also formulated plans for the electrification of their suburban services; in Brisbane work has been commenced on the project. A beginning has also been made in New South Wales and Victoria on the work of main-line electrification, and some important lines are likely to be electrified within the next few years. Practically all main-line railway traffic is at present steam hauled, but substantial orders have recently been placed for diesel-electric locomotives for main-line traction, and the first of these have come into service.

Road Transport

Apart from suburban passenger tramway and omnibus services, road transport in Australia is mostly in the hands of private operators. The number of privately-owned cars and trucks is very large in proportion to population and reflects the general prosperity of the nation as a whole. Until the end of the 1914-18 War, the road systems were not developed to any great extent and were chiefly used for local horse-drawn traffic. During the 1920's, however, there was a great increase in motor vehicles, and in each State an authority was constituted to construct and maintain highways and main roads so that there is now a widespread system of such roads. Heavy traffic, however, is now seriously impairing main highways.

Road construction has been largely financed by taxation on motor vehicles, supplemented by Commonwealth grants. In order, however, to maintain railway finances (which, as indicated above, are a governmental responsibility) against road competition, particularly in the more profitable traffic, each State has instituted a measure of control over commercial road vehicles. These measures of control are by no means uniform in the various States, ranging from a very strict control in Western Australia to a relatively easy one in Victoria, but they are all directed to the reduction or elimination of road competition with existing railway lines, by imposing a system of conditional licensing of commercial vehicles.

During the 1939-45 War, and in the post-war period, the great strain on the railway systems led to some relaxation of these controls, and since the war there has been a very large increase in the number of goods road vehicles and a corresponding increase in the quantity of traffic carried. The railway authori-

ties are feeling the renewed effect of road competition.

Shipping

Shipping in Australian waters, both coastal and overseas, has mainly been a province of private operators. Coastal services are provided mainly by Australian companies, some of which are associated in various ways with shipping interests in the United Kingdom. Since the war, there has been a definite shortage of shipping on the Australian coast and as indicated elsewhere the Commonwealth Government embarked on a policy of ship building in Australia to replace and maintain the local merchant fleet at an appropriate level. Most of the ships built by the Commonwealth Government in this way were retained in Commonwealth ownership, and used particularly for bulk cargoes. (See Part Two, Chapter 10, "Transport Equipment".) The future ownership of shipping by the Commonwealth Government is in doubt. All types of deep-sea services, except tanking, are supplied by local operators, i.e., passenger, general cargo, ore carrying, etc. The Australian coast, however, is notably lacking in good harbours. Apart from the capital cities (development of which was in every case dependent on its being the natural entrepot for sea-borne trade) such ports as are available are either river ports, in which case their capacity is limited by bars, or harbours artificially constructed at considerable expense and with limited potentialities. Coastal trade is therefore chiefly between the capital cities and a few special ports, the latter mostly associated with the iron and steel industry. Inland water traffic is non-existent with the exception of a little traffic on the Murray River system.

Air Transport

The outstanding feature of Australian transport development since the 1939-45 War has been the enormous growth of internal air services. Australia is peculiarly suited to air transport and a great network of routes now covers the whole country. In the more remote and very sparsely populated areas, air transport has become the primary means of communication; in the important services between the mainland and Tasmania, passenger traffic carried by air considerably exceeds that carried by sea. Australians fly far more mileage per head of population than the inhabitants of any other country, and air services, in frequency, quality and fares, compare more than favourably with those elsewhere. The increase in air-freight traffic has been particularly great, and its growth continues at a phenomenal rate.

There are a number of internal operators, all but one of which are private organisations. However, practically all inter-capital traffic is in the hands of two large operators—one private, and one an agency of the Commonwealth Government. The latter, which was established in 1946, has been steadily increasing its proportion of the traffic handled, and on several of the important inter-capital routes now exceeds the proportion carried by the private operator.

COMMUNICATIONS

Postal, telegraph and telephone communications in Australia are a constitutional monopoly of the Commonwealth government.

Telephone services in particular are highly developed and in terms of telephone stations per head Australia ranks very high among the

countries of the world. The equipment used is of the most modern type and in all capital cities, and in some of the other large centres of population, telephone services are predominantly automatic. As in other fields, the war and postwar period resulted in a greatly increased demand for communication services, a trend accentuated by the very high level of prosperity in the community. There is ac-

cordingly a grave shortage of equipment and a long waiting list of persons requiring telephone services, but this is slowly but steadily being overcome.

Trunk-line communications are available from practically any point in the Commonwealth to any other point. Overseas telegraph and radio telephone communication is available to all important countries of the world.

FINANCE

Banking

Commonwealth Bank. This bank, established in 1911, acts as a Central Bank and controls the issue of currency. It also provides general banking facilities in competition with the trading banks. Under the Banking Act 1945, the Commonwealth Bank was entrusted with the task of the co-ordination and direction of banking policy; with the control of the volume of credit and bank interest rates; and with the control of Australian foreign exchange and gold resources.

Trading Banks. There are seven privately-owned trading banks in Australia operating in competition with each other and with the Commonwealth Bank. These conduct between them the great part of commercial banking and financing, traditionally on overdraft. Some are overseas organisations, the capital holdings being chiefly British, whereas others are locally owned and controlled. There are very few centres of population which are not served by branches of one or more of the trading banks.

Savings Banks. Savings bank activity is entirely in the hands of the Commonwealth and States. The Commonwealth Savings Bank of Australia operates throughout the whole Commonwealth and most Post Offices outside city areas are agencies of this bank. The State Savings Banks are limited, of course, in their sphere of operations to their own States. These banks are designed to attract the small depositor, and funds are invested conservatively.

Insurance

Insurance is, for the most part, in the hands of private companies, although there are some Government offices in this class of business. These latter are, to a substantial extent, con-

cerned with workers' compensation insurance. The most important class of insurance office is that handling life policies and these engage in industrial investment.

Fire, shipping and general insurance are also adequately catered for. All States require motor-vehicle owners to take out third-party accident policies and this class of business is accordingly considerable.

Private Investment

Private investment is chiefly carried out through stock exchanges, which are found in all capital cities. There are a number of issuing houses which underwrite capital issues, and much industrial investment is handled in this way. Before any major capital issue can be made, however, the consent of the Capital Issues Control Board (a Commonwealth instrumentality) must be obtained. It is the declared policy of the Commonwealth Government to direct investment into avenues associated with defence or strengthening the economy in war.

Governmental

Both the Commonwealth and State Governments from time to time provide finance for specific projects, and most developmental works undertaken by Government Departments or authorities are financed from public funds. In addition, however, various Governments frequently support private ventures, either by direct investment or indirectly by subsidy. Apart from the Governmentally-owned banks, however, there is no specific Government agency entrusted with the task of affording finance from public funds, although from time to time the desirability of such an agency has been canvassed. (See also Appendix II.)

BUILDING AND CONSTRUCTION

In this important group of activities, both Governmental and private organisations have extensive interests.

Building

Until the 1939-45 War, building was chiefly in the hands of private contractors, ranging in size from "one-man" businesses chiefly engaged in home building, to large companies whose activities lay mainly in the erection of city office blocks, hotels, etc. However, in some States, Housing Commissions had been created by statute to provide housing accommodation; these, however, frequently contracted with private firms for the actual construction work.

The great backlog in housing accommodation resulting from the war and the subsequent intensive migration policy has led to an enlargement of Government activity in this field, and in each State there is a Governmental authority concerned with the construction of

dwelling, either carrying out the construction itself or contracting for it with private firms.

At the same time, it was found necessary to ensure that the greatest possible supplies of materials and manpower are directed to home building. The erection of other types of structure, including factories, was therefore made subject to the grant of a permit by the State authorities, permits not being issued unless a satisfactory case for the erection of a building can be shown. The Commonwealth Government has also created a Federal authority which administers Commonwealth functions in respect of housing, in particular the administration of the Commonwealth/State Housing Agreement under which the Commonwealth supplies financial assistance to the States for home building.

Constructional Works

The greater part of major constructional works in the Commonwealth is undertaken by

Commonwealth, State or local government authorities. Provision of such services as water, sewerage, roads, harbours, electricity supply, is predominantly the function of State or local government authorities, being usually carried out by special bodies created under State statutes.

Since the war, the Commonwealth has entered this field, and one of the most important constructional projects, the Snowy

Mountains Hydro-Electric Scheme, is being undertaken by a Commonwealth statutory body appointed for the purpose.

The generation and reticulation of town gas remains largely in private hands.

The construction of public utilities is sometimes carried out by the authority itself and sometimes by private firms, contracting with the authority.

PROFESSIONAL AND TECHNICAL SERVICES

Responsibility for education lies principally in the hands of the State Governments, although the Commonwealth has certain obligations in the field and has created an Office of Education to discharge them. Primary education is compulsory in all States; compulsory attendance at school is required between the ages of 5 and 15, although these ages are not uniform between all States. There is an extensive network of high schools, technical high schools and so on, providing secondary education up to university matriculation standard. Each State maintains a university with a wide range of faculties affording degrees in all the more important branches of academic learning and technology.

The standards achieved by these universities are sufficiently high to be recognised throughout the world, and a local supply of culturally, professionally and technically trained personnel is thus assured for public service, for private professional practice and for industry.

Recently a National University was established at Canberra which will cater for post-graduate and research studies. A new departure in Australian technical training has also been undertaken in Sydney where a University of Technology has been established for training in applied sciences.

Besides the universities, each State maintains a system of technical schools and colleges which afford training in trades and professions on a lower level than that given in the universities. Practically all professional activities and many trades are regulated by statutes, requiring practitioners to demonstrate a sufficient degree of skill before being allowed to practise, and professional bodies also exist in most fields to ensure that the standards are maintained.

Another Commonwealth instrumentality, the Commonwealth Employment Service, has been created for the purpose of assisting in the placement of workers of all kinds (its organisation including a Higher Appointments Office for technical professional and managerial personnel). (See also Appendix II.)

There are also several organisations, both public and private, engaged in research of various types, the most important of which is the Commonwealth Scientific and Industrial Research Organisation, maintained by the Commonwealth Government. The Commonwealth and State Governments are jointly associated in the preparation and publication of a wide range of statistical material, including statistics on trade and production. (See also Appendices II and IV.)

SOCIAL SERVICES

The Commonwealth Government provides a number of social services. These include invalid, widow's and old-age pensions, child endowment, maternity allowances, the provision of sickness and unemployment benefits and repatriation benefits to ex-servicemen.

Public hospitals are predominantly financed by State and local governments although the Commonwealth Government operates a scheme whereby it subsidises the cost of hospitalisation

on the basis of daily occupancy of beds.

A comprehensive scheme for national health services has been debated in the Commonwealth legislature for some time, but has not yet been completely incorporated in legislation. As a first instalment of a more comprehensive scheme the Commonwealth Government provides certain drugs free of charge, and also affords substantial hospital benefits.

INDUSTRIAL RELATIONS

The regulation of relations between employer and employee is the responsibility of Federal and State statutory authorities set up for the purpose, of which the most important is the Commonwealth Court of Conciliation and Arbitration. These exercise judicial or quasi-judicial functions, and their decisions have the force of law. The system of conciliation and arbitration is peculiarly Australasian

and is a unique feature of the Australian social structure. It is largely dependent on the organisation of employers into industrial federations and employees into industrial unions. Practically all the workers employed in manufacturing industries in Australia are members of trade unions. Collective bargaining with employers is not widely practised in Australia.

PUBLICITY AND ADVERTISING

Australia is served by many newspapers and periodicals (including a substantial number of trade journals catering for manufacturers in specific industries) and also by a

large number of broadcasting stations, affording a coverage of practically the whole population.

Newspapers and periodicals are, for the most part, privately owned and operated, as are a large number of broadcasting stations. The Commonwealth Government, however, through the medium of the Australian Broadcasting Commission, owns and operates a considerable network of broadcasting stations covering most of the Commonwealth on a regional basis. The Australian Broadcasting

Commission does not accept advertising, but all privately-owned broadcasting stations make it an important feature of their operations.

Advertising, both national and local, is therefore provided with a full range of media. A number of advertising agencies, including many international agencies, offer their services to industry.

Appendix II:

CUSTOMS TARIFF

TAXATION

AIDS TO INDUSTRY

IMMEDIATE POLICY ON INDUSTRIAL
EXPANSION

Customs Tariff, Taxation, Aids to Industry, Industrial Expansion Policy

IT has been the long-term policy of Australian governments to encourage the development of manufacturing industries which are reasonably assured of sound opportunities of success, which assist the diversification of the Australian economy, contribute to employment and result in the development of resources. A principal method of encouragement has been that of market protection through the use of Customs tariff duties. This is briefly explained in the next section. Other methods employed to encourage industries, including taxation concessions, technical and financial assistance, are referred to in the subsequent text. Because of severe shortages of essential materials and labour and the growing needs of development and defence preparedness, a selective policy has been adopted in recent years toward industrial expansion.

THE AUSTRALIAN CUSTOMS TARIFF

The working document called the Australian Customs Tariff is subdivided into three columns, under which duties are imposed, as follows:—

1st Column: The British Preferential Tariff—

This tariff contains, for the most part, lower rates of duty than apply under other columns. It is imposed on goods of United Kingdom origin and, except where otherwise indicated in the tariff, on goods of Canadian and New Zealand origin. For some goods, these rates are also applicable to the produce of British Protectorates, Trust Territories and non-self-governing Colonies and Ceylon.

2nd Column: The Most-Favoured-Nation Tariff—

This is the tariff applicable to goods from those countries proclaimed by the Government as being entitled to most-favoured-nation tariff treatment. The rates of duty are generally lower than those under the General Tariff. As at 1st August, 1952, the only important trading countries whose products did not receive most-favoured-nation treatment were Eastern Germany and Japan. In most cases, there is a margin of preference between the British Preferential Tariff and the Most-Favoured-Nation Tariff.

3rd Column: The General Tariff—

These are the highest customs duties imposed on imports into Australia. They apply to imports from all countries whose products are not subject to preferential or most-favoured-nation rates of duty.

The duties referred to above are imposed under Customs Tariff Acts. In addition to duties imposed under the Acts, there are also imposed, on a wide range of goods, special revenue duties under the Customs Tariff (Primage Duties) Act. The former duties are commonly referred to as Customs duties and the latter duties as Primage duties.

The administration of the Australian Customs Tariff is the responsibility of the Department of Trade and Customs under the Comptroller-General of Customs in Canberra. The protective tariff policy is implemented through the Commonwealth Tariff Board. After public inquiry, where both domestic and overseas interests have full rights of audience, the Tariff Board recommends to the Government what tariff duties should be imposed on imported goods in order to afford reasonable protection to Australian industry on the basis of economical and efficient production. The Tariff Board is also enabled to recommend assistance to Australian industries by the payment of bounties.

In brief, it may be said that the Customs Tariff is the major instrument for the protection of Australian industry against overseas

competition and an important factor in raising of Commonwealth revenue, and that the degree of protection afforded is very largely established from the findings of the Tariff Board.

Australia has entered into trade agreements with other countries, the principal of which are the United Kingdom-Australia Trade Agreement (the "Ottawa Agreement") and agreements with Canada and New Zealand. In addition, Australia is a signatory to the General Agreement on Tariffs and Trade which came into force provisionally in 1947. The General Agreement on Tariffs and Trade is in effect a multilateral trade agreement, designed primarily to encourage the expansion of international trade. Under this agreement many reductions have been made in Australian customs and primage duties since 1947 and some of these resultant duties have been bound against increase. These bindings are subject to review every three years. Margins of preference between British Preferential and Most-Favoured-Nation rates have also been bound against increase.

Australia is, however, still permitted by the General Agreement on Tariffs and Trade to impose import restrictions to protect her balance-

of-payments position; to take emergency action if any industry is endangered by any tariff or preference reduction negotiated; and to impose new duties for protective purposes except where a country specifically has accepted, or may accept, a binding in tariff negotiations. The Agreement also provides for such matters as "dumping" duties and the payment of subsidies. These "dumping" duties are provided for under the Customs Tariff (Industries Preservation) Act 1921-1936. This Act permits special duties to be collected in specific cases when it is considered by the Tariff Board that the importation of certain goods would be detrimental to an Australian industry.

Further information on the Tariff is to be found in Commonwealth Year Book, No. 38, 1951, Chapter XII, Section 2, published by the Commonwealth Statistician, Canberra, A.C.T.

Import Licensing

As from the 8th March, 1952, all imports (other than such minor non-commercial items as passengers' luggage) into Australia from all sources must be covered by a valid import licence (Department of Trade & Customs Instruction V-1.52/151 dated 11/3/52). The Instruction does not affect the existing licensing treatment of imports from the Dollar Area and Japan.

Goods have been divided into three categories, viz., category "A", category "B" and an "Administrative" category. Imports within category "A" and category "B" will be regulated according to quotas to be allocated to importers based on their importations during the financial year 1950-51. Quotas for imports within category "A" will amount to 60 per

cent. of individuals' (including firms') importations during the base year. Quotas for imports within category "B" will amount to 20 per cent. of individual importations during the base year.

The "Administrative" category comprises goods which of their nature or for some other reason do not lend themselves to quota treatment and applications to import them are given individual consideration.

Quotas will be allocated on a quarterly basis and quotas or portions thereof unused at the end of the quarter may not be carried forward into subsequent quarters.

The "Administrative" category includes, broadly, those items and raw materials which are essential to the Australian economy for defence, food production or developmental purposes and which are in short supply in Australia.

Category "A" includes, broadly, goods which are not made in Australia, or which are made in Australia in insufficient quantities to meet the demand, and for which imports have normally been the principal source of supply.

Category "B" includes, broadly, goods which are made in Australia in sufficient quantities to meet essential requirements, many consumer goods, and luxury goods.

Applications for licences for goods under "quota" control should be made to the Collector of Customs at the port of intended importation and for goods under "Administrative" control to the Administrative Officer, Central Import Licensing Branch, Department of Trade & Customs, 52 William Street, Sydney.

TAXATION

In the following notes the taxation rates for 1951-52 are given and the proposed rates for 1952-53, as outlined in the Treasurer's Budget speech on 6th August 1952, are given in parenthesis.

The Commonwealth Parliament is the sole authority in Australia imposing taxes on incomes. No tax is imposed in Australia upon capital gains.

Non-residents of Australia are taxed on income derived from sources in Australia. Residents of Australia are taxed on income from all sources, provided, however, that income (other than dividends) derived from sources outside Australia is exempt if it has borne tax in the country in which it was derived. Where dividends are paid to a resident of Australia by an ex-Australian company out of profits having their source out of Australia, double taxation is relieved by a tax credit granted by Australia.

Taxation of Company Incomes

The incomes of companies are subjected to tax. Public companies (see Appendix IV) pay income tax at the rate of 7/- in the £, and, in addition, a special levy of 2/- in the £ is imposed.

The special levy of 2/- in the £ is not levied on dividends paid to companies not resident in Australia.

The tax liability of companies for each financial year is based upon profits derived in the preceding financial year. A considerable period of time accordingly elapses between the receipt of income and the payment of tax on that income.

During the financial year ended 30th June, 1952, both public and private companies were required to make an advance payment towards their ultimate liability for tax on profit of that year. The amount of the advance payment was 10 per cent. of the tax levied on the income of the year ended 30th June, 1951. A credit for the amount paid as advance payment was allowed against the tax assessed on income for the year ended 30th June, 1952.

(A reduction of 2/- is proposed in the rate of tax on the first £5,000 of taxable income derived by public companies. The rate at which tax will be payable on incomes of public companies for the year ended 30th June, 1952, including the levy of 2/- in the £ imposed last year, will accordingly be—

7/- in the £ on the first £5,000 of taxable income, and

9/- in the £ on the balance of taxable income.

The system of advance payments by companies instituted last year will be discontinued. The advance payments imposed in respect of the income of the year 1950-51 will be credited against company tax assessable during the current financial year.)

In the case of private companies the rates of tax are: 5/- in the £ on the first £5,000 taxable income; 7/- in the £ on the balance of the taxable income. The special levy of 2/- in the £ is not imposed in the case of private companies. However, a private company which is a resident of Australia or which carries on business in Australia by means of a principal office or branch may be liable to tax on undistributed income.

Before referring more fully to the tax on the undistributed profits of private companies, it is mentioned that, briefly stated, a private company (for the purposes of the taxation laws) includes a company which has not more than 20 shareholders or which can be controlled by not more than seven persons. There are other circumstances in which a company may be a private company and a more detailed description of a private company will be made available on application. It can, however, be observed that a private company does not include a company in which the public is substantially interested or a subsidiary of a public company.

In ascertaining the amount subjected to undistributed profits tax, private companies are permitted to deduct specified portions of their incomes. This concession enables a measure of capitalisation of profits to be achieved without liability being incurred for undistributed profits tax.

For the benefit of those concerned with a more detailed appreciation of the basis upon which the undistributed profits tax is imposed, it is mentioned that it is levied upon the taxable income of private companies less the aggregate of—

the income tax payable on that taxable income; certain other taxes (e.g., tax paid in another country on income assessable for Commonwealth purposes); net losses incurred in carrying on business out of Australia;

the portion of the taxable income remaining after subtracting therefrom the abovementioned deductions and dividends received from other private companies, which equals a total of amounts ranging from 50 per cent. of the first £1,000 of distributable income down to 10 per cent. of the excess of distributable income over £10,000;

(Commencing with the income year 1951-52, the Government proposes to increase the minimum retention allowance to 25 per cent. Where the present retention allowance exceeds 25 per cent. the greater amount will still apply. The new scale will be as follows—

on the first £1,000 of distributable income, 50 per cent.

on the second £1,000 of distributable income, 40 per cent.

on the third £1,000 of distributable income, 35 per cent.

on the fourth £1,000 of distributable income, 30 per cent.

on the balance of distributable income, 25 per cent.)

dividends paid out of the taxable income within six months (nine months in the case of a company not a resident of Australia) of the end of the year of income in which the taxable income was derived; and

deemed dividends, e.g., excess distributions of four preceding years; remuneration paid to directors and shareholders in excess of reasonable amounts and treated as dividends in hands of recipients.

The amount of undistributed profits tax payable by a private company approximates closely to the additional amount of tax which shareholders would have paid if the undistributed amount had been paid to the shareholders as dividends at the end of the year of income in which the profits were derived. The liability of a private company may accordingly depend in part upon the rates of tax imposed upon the incomes of individuals. (The Government now proposes that the undistributed income tax shall, in future, be levied at a flat rate instead of the shareholders' graduated rates of tax. The flat rate now proposed is 10/- in the £.)

Taxation of Income of Individuals

Examples of the tax payable by individuals without dependants on income from personal exertion are—

Total Taxable Income	Tax Payable
£100	—
250	£8 1 0
500	39 9 0
1,000	148 10 0
1,500	309 16 0
2,000	515 4 0
3,000	1,021 4 0
4,000	1,615 4 0
5,000	2,297 4 0

In addition to the amounts shown, an individual whose total taxable income exceeds £400 and who derives over £100 taxable income from property (which includes rents, interest and dividends) pays a further rate of tax. This further rate of tax is—

On the part of the taxable income from property which—

exceeds £100 but does not exceed £1,000	8 pence in the £
exceeds £1,000 but does not exceed £4,000	16 pence in the £
exceeds £4,000 but does not exceed £8,000	8 pence in the £
exceeds £8,000 but does not exceed £10,000	4 pence in the £
exceeds £10,000	nil

It is, however, provided that, where the total taxable income does not exceed £1,000, the further tax on property income shall not exceed 1/- in the £ on the excess of the taxable income over £400.

(The above rates include a special levy of 10 per cent. of income tax and social services contribution. It is proposed not to impose this special levy in 1952-53.)

Taxation of Dividends

Generally speaking, dividends are assessable income in the hands of residents of Australia. In the case of non-residents only dividends paid out of profits derived from sources in Australia are assessable income. Concessions granted under the United Kingdom-Australia Double Taxation Agreement are set out below.

Dividends included in the taxable income are, generally speaking, subjected to tax in the hands of individual shareholders without any allowance or credit for taxes borne by the company, but a rebate is allowed in respect of dividends paid wholly and exclusively out of funds which have been taxed as the undistributed profits of a private company. The rebate equals the whole of the tax attributable to those dividends.

Dividends received by a company resident in Australia from other companies are included in the assessable income of the recipient company, but a rebate which offsets the income tax and special levy imposed is allowed to that company. When those dividends ultimately reach the hands of individual shareholders they bear tax in the ordinary way.

Dividends received by a company not resident in Australia are assessable income to the extent that they are paid out of profits derived from sources in Australia. A rebate to offset the tax assessed on these dividends is not allowed, as subsequent dividend distributions by the non-resident company would not usually bear Australian tax.

Double Taxation of Incomes

It will be observed from an earlier paragraph that Australia protects her own residents from the burden of double taxation on incomes derived from sources out of Australia.

Correspondingly, the Australian view is that it is appropriate for relief from double taxation on income derived from Australian sources by non-residents of Australia to be granted by the country in which the recipient is resident.

A number of countries accept this view, which permits overseas investments to be made in Australia without suffering double taxation of the income arising therefrom. In the case of the United States of America, the allowance by the United States of tax credits in respect of Australian tax on income derived from Australian sources by United States residents, relieves the burden of double taxation.

Where a United States corporation trades by means of a subsidiary company incorporated in Australia, the tax credit allowed by the United States against its tax on dividends paid to the parent corporation takes into account the Australian tax on both the subsidiary company's profits and on the dividends paid by that company to the parent corporation. The amount of the tax credit is of course, determined by provisions of the United States Internal Revenue Code.

If a United States corporation trades in Australia by means of a branch, the Australian profits are taxed by Australia and a tax credit is allowed by the United States against its tax on those profits.

United Kingdom-Australia Double Taxation Agreement

Relief from double taxation in respect of incomes flowing from Australia to residents of the United Kingdom and vice versa is provided by the provisions of the United Kingdom-Australia Double Taxation Agreement. The main provisions of this agreement, insofar as they affect United Kingdom industrial and commercial enterprises, apply to manufacturing and trading profits, dividends and royalties.

Manufacturing and trading profits derived by United Kingdom residents from the activities of a permanent establishment in Australia are assessable income. The activities of certain agents who operate in Australia are not classified as representing permanent establishments. If the profits taxed in Australia are again taxed in the United Kingdom, a tax credit is allowed against the United Kingdom tax on the profits. The credit, the amount of which is determined in accordance with United Kingdom law, is designed to reduce the total burden of the taxes to an amount equal to the Australian tax or the United Kingdom tax on the profit, whichever is the higher.

Exemption from Australian tax is granted in respect of dividends paid out of Australian profits by United Kingdom companies to shareholders who are United Kingdom residents.

Dividends paid by Australian companies to parent companies which are United Kingdom residents are also exempt from Australian tax if the following conditions are satisfied—

- the dividends are subject to United Kingdom tax;
- the recipient company beneficially owns all the shares (other than directors' qualifying shares) in the paying company;

the directors' qualifying shares do not exceed 5 per cent. of the paid-up capital of the company paying the dividends; and ordinarily not more than 50 per cent. of the income of the company paying the dividends is derived from interest, dividends and rents, other than interest, dividends and rents received from a wholly-owned subsidiary company the taxable income of which consists wholly or mainly of industrial or commercial profits.

Where dividends paid to United Kingdom residents out of Australian profits are not exempt under the provisions mentioned, the amount of Australian tax payable on the dividends is reduced (if the dividends are subjected to United Kingdom tax and the recipient shareholder is not trading through a permanent establishment in Australia) to 50 per cent. of the amount which would otherwise have been payable. The amount of undistributed profits tax payable by a private company is not, however, affected by concessions in respect of dividends. Somewhat similar provisions for the relief of incomes flowing from the United Kingdom to Australia are embodied in the Agreement.

The Agreement contains a provision relating to royalties paid as consideration for the use of copyrights, patents, designs, secret processes and formulas, trade-marks and like property. It does not extend to royalties paid in respect of the operation of a mine or quarry or of other extraction of natural resources or a royalty in respect of a motion picture film.

The provision requires Australia to exempt from tax, royalties to which it applies, provided the royalty is subjected to United Kingdom tax and the recipient is a resident of the United Kingdom who is not trading through a permanent establishment in Australia. A comparable exemption from United Kingdom tax applies in respect of royalties derived by residents of Australia.

The double taxation agreement between Australia and the United Kingdom contains a number of other provisions of a less general interest. If further information is desired it will be supplied if application is made, at the addresses given below, to the Commissioner of Taxation, or to the Australian Taxation Representative in London.

Depreciation

In the ascertainment of taxable incomes, deductions are allowed for depreciation of plant and articles owned by the taxpayer and used by him, or installed ready for use, in the production of assessable income. The total of all depreciation deductions in respect of any unit of plant or article cannot exceed the cost of that unit or plant.

Depreciation deductions are allowable in respect of the portion of buildings which are integral parts of plant and which are plumbing fixtures and fittings, including wall and floor tilings and internal partitions, installed in premises provided principally for the use for personal purposes of the employees of the taxpayer.

Depreciation at a rate of 33½ per cent. is allowable in respect of certain plant and equipment used by employers to provide amenities for employees. This rate applies in respect of plant and equipment used in dining rooms, cafeterias, etc., and to such property as clothing cupboards, lockers and similar fixtures and fit-

tings (not forming part of the permanent building structure) used in locker rooms and in accommodation used for changing, resting, recreational and first-aid purposes. It will also extend to plumbing fixtures and fittings forming part of the equipment of cafeterias, kitchens and rest or recreation rooms.

Scientific Research

A deduction is allowed for income-tax purposes in respect of payments to an approved research institute for scientific research related to the taxpayer's business or related to that class of business. Certain classes of capital expenditure, e.g., expenditure on the construction of buildings of value for research purposes only, are also deductible.

Concessions for Executives, Technicians, etc., Visiting Australia

The general import of provisions relating to remuneration in the form of director's fees, salary or wages, derived by a non-resident during a visit to Australia, is that the remuneration shall, for a period not exceeding four years, be subjected in Australia to no greater income tax than would be paid if the remuneration had been derived in the country in which the visitor is ordinarily resident.

It is a pre-requisite to the application of the material provisions that the visitor shall, during his visit to Australia, act as a director, manager or other administrative officer, or, or be employed as a consultant technician or operative in, a manufacturing, mercantile or mining business or a business of primary production.

In the first year of the visit, the remuneration of the visitor will be exempt from Australian income tax if that remuneration is subjected to the tax in the country where he is ordinarily resident. If, however, the remuneration is exempt from tax in that country, the visitor will be required to pay Australian income tax, but to no greater extent than the tax that he would have been obliged to pay to the country of ordinary residence if tax on the remuneration had been imposed by that country.

PATENTS

Australian industrialists and those overseas interested in, or contemplating the establishment of, local industries are encouraged by the fact that Australia is a member of the International Union for the Protection of Industrial Property and grants reciprocal facilities in common with the principal countries of the world which are members of the Union. The Australian Patent Office receives and makes available copies of patent specifications from

FINANCIAL ASSISTANCE

The financial needs of secondary industry generally and of credit-worthy small undertakings in particular are specially catered for by the Industrial Finance Department of the Commonwealth Bank of Australia. This Department was inaugurated in 1946 to provide finance, at low rates of interest, for the establishment and development of industrial undertakings and to advise on their operations with the object of promoting efficiency in their organisation and conduct.

Subject to the Industrial Finance Department being satisfied as to the credit worthiness of

In the second year of the visit, the provisions apply in the same manner as for the first year, provided, however, that the Division of Industrial Development of the Department of National Development certifies, and the Commonwealth Treasurer is satisfied that the retention of the visitor's services beyond the first year will assist or has assisted in the development of Australian industry.

In the third and fourth years of the visit, the remuneration derived by the visitor in Australia is not exempt from Australian income tax, irrespective of payment of, or exemption from, tax in the country where he is ordinarily resident. If, however, the Division of Industrial Development certifies and the Treasurer is satisfied that the retention of the visitor's services beyond the second and third year will assist, or has assisted, in the development of Australian industry, the visitor will not be required to pay Australian income tax of any greater amount than he would have been obliged to pay if the remuneration had been derived in the country where he is ordinarily resident.

Payroll Tax and Sales Tax

A tax of 2½ per cent. on wages and salaries exceeding in the aggregate £20 a week is payable by all employers; this is a deduction for income-tax purposes. A purchase tax ranging between 12½ and 50 per cent. is levied on the cost of many commodities sold; this is passed on to the consumer.

General Information

The information above is necessarily general in nature and if more detailed advice is desired regarding the interpretation and application of Australian laws relating to the taxation of incomes, enquiries can be addressed to—

Commissioner of Taxation,
CANBERRA, AUSTRALIA.

or—

Australian Taxation Representative,
Australia House,
Strand,
LONDON, W.C.2. ENGLAND.

all the principal Patent Offices in the world and has a copy of every British specification printed since early in the 17th century. Australian patent specifications are printed and made available at the Patent Office and at Trade Marks sub-offices in the capital cities of the Commonwealth where copies may be purchased. Photographic copies of specifications other than Australian may also be obtained.

an applicant, it is prepared to consider any application to assist in financing the establishment of an industrial undertaking of any kind or the expansion or purchase of an existing business in this category. This may involve the purchase or erection of business or factory premises, the acquisition of plant, machinery and motor vehicles, the purchase of stock, or the provision of working capital. Assistance may be granted by way of overdraft, fixed loan, hire purchase, subscription of share capital, underwriting of a share issue, or a combination of any two or more of these methods.

The facilities are available at the Bank's 420 Branches throughout Australia and applications for assistance may be lodged at any of these points.

The Industrial Finance Department has on its staff highly qualified specialists who are practical and experienced in accounting, costing, valuing, commercial practices, production methods and manufacturing techniques. The services of these specialist officers are readily

available, free of cost, for assisting in the establishment and development of industrial undertakings and for advising on their operations. In addition, the Industrial Finance Department receives the ready co-operation of the Division of Industrial Development of the Department of National Development, which when requested carries out technical investigations of various projects, and also market surveys covering the manufacturing and consumer potential of any particular industry.

TECHNICAL AID

Through various agencies the Commonwealth Government assists industries with research, investigations, technical information and technical advice, most of which is made available free of charge. The most important of these services and organisations concerned are briefly as follows—

The Commonwealth Scientific and Industrial Research Organisation

The Commonwealth Scientific and Industrial Research Organisation is the chief government agency for carrying out research to assist primary and secondary industry. In establishing it the government has recognised that national security and development necessitate research on a scale often beyond the capacity of individual persons or enterprises. The responsibilities imposed on C.S.I.R.O. by the Science and Industry Research Act 1949 include the initiation and carrying out of researches and investigations in connection with or for the promotion of primary and secondary industries, the training of scientific research workers, the making of grants in aid of pure research, the support of industrial research associations, the standardisation of scientific instruments and apparatus and the dissemination of scientific and technical information. It derives its funds from direct government grants and from industrial contributions.

The work of the C.S.I.R.O. is carried out in a number of laboratories and field stations in different parts of the Commonwealth. These include those dealing with plant industry, entomology, animal health and production, biochemistry and nutrition, soils, irrigation research and fisheries. These laboratories work in close association with Commonwealth and State instrumentalities and with producers' organisations. C.S.I.R.O. does not itself take part in direct extension work to individual farmers—this is the responsibility of the State Governments.

Research for secondary industry has not been in progress for as long as that for primary industry; its development has been accelerated during and since the 1939-45 War. The National Standards Laboratory in Sydney is the Australian counterpart of the National Physical Laboratory in Great Britain and the Bureau of Standards in U.S.A., and has the legal responsibility of maintaining Australian standards of measurement. It consists of three divisions—Metrology, Electrotechnology and Physics. Other laboratories cover the fields of industrial chemistry, radio-physics, fuel, mine-ragraphy and ore dressing, physical metallurgy, tribophysics, forest products, food preservation, building, wool textiles and flax.

C.S.I.R.O. maintains a comprehensive library service accessible to the public in all its laboratories, with a central index in Melbourne. Most

of the laboratories maintain information officers who are in close touch with industry.

The head office of C.S.I.R.O. is at 314 Albert Street, East Melbourne, C.2.

Defence Research Laboratories

Among the agencies that can contribute to the provision of scientific assistance to industry in Australia are the Defence Research Laboratories. As a major unit of the Research and Development Branch of the Department of Supply the primary function of D.R.L. is to do research and development, investigational and testing work for the Department of Supply and for the three Service Departments (Navy, Army and Air).

A complementary function is the provision of assistance to other government departments and to secondary industry on scientific and technical matters (a) in a consulting and advisory capacity and (b) in the calibration of instruments and testing equipment, and the carrying out of some chemical and physical testing of a specialised nature. Assistance given to industries and firms is limited in the main to those considered to be of importance to the overall industrial defence potential, and the amount of such work that can be undertaken is contingent upon the requirements of programmes of work for the Supply and Service Departments. Fees are charged for work carried out for non-defence clients.

The work of D.R.L. lies in the fields of applied physics, chemistry, metallurgy and certain branches of engineering.

D.R.L. headquarters are in Melbourne, at which facilities in all of the fields mentioned have been developed, and there are branches at Sydney and Adelaide. An important feature of the establishment is the grouping within one organisation of a large number of scientists trained and experienced in many diverse fields, enabling all-round attack on scientific and technical problems. The total scientific and technical staff is 450, of whom 200 are professional officers, viz., physicists, chemists, metallurgists and engineers. The major fields of work in Melbourne are—

Applied Physics: This includes optics, electronics, electrical and temperature measurement and standardisation, and construction of experimental optical, electrical and mechanical instruments and equipment.

Metrology: Typical work is the development of precise measuring methods, the design of gauges, and the standardisation and calibration of equipment for measurement of length, mass and volume.

Metallurgy: The wide range of metallurgical work includes physical metallurgy (development of new materials, investiga-

tion of failures, experimental working and heat treatment), chemical metallurgy (electroplating, corrosion and analytical chemistry), industrial radiography and other non-destructive testing methods, scientific and technological aspects of welding and casting, and pyrometric standardisation and testing.

Applied Chemistry: Typical fields of work include explosives and ammunition, paints and allied materials, lubricants, textiles and mycology, absorption of gases in solids, atmospheric pollution and air filtration, and the detection and estimation of gases, vapours and dusts in the atmosphere.

Other fields include engineering (physical testing and calibration of testing equipment, research on mechanical properties of materials), crystal physics (electron microscopy and diffraction, X-ray diffraction, and their use as research tools), and technical information (supply of scientific and technological information, including the preparation of bibliographies and information circulars).

In Sydney (N.S.W.) and Adelaide (S.A.), branch laboratories are equipped mainly for metallurgical work (principally industrial radiography and general metallurgical investigations) but a limited range of chemical work is also done. The branches also provide a technical information service.

Inquiries may be addressed to—

HEADQUARTERS:

Chief Superintendent,
Defence Research Laboratories,
Private Bag No. 4, P.O.,
ASCOT VALE. VIC.

LABOUR

The Department of Labour and National Service is the Commonwealth agency concerned with Australian industrial relations in their national and international phases, industrial training and the promotion of industrial welfare. It is also responsible for the conduct of the Commonwealth Employment Service and for the accommodation and employment control of certain classes of migrants. It attends to the various labour matters arising from Australia's membership of the International Labour Organisation. The Department is the normal channel of communication between the Commonwealth Government and industrial organisations of employers and workers.

The Department of Labour and National Service comprises a central secretariat responsible for general policy formulation, the co-ordination of all the Department's activities and functions, industrial matters concerned with the coal, stevedoring and maritime industries, and the general administrative services, and five divisions, namely: Industrial Relations and General, Industrial Training, Industrial Welfare, Employment and Migrant Workers' Accommodation Divisions.

(a) The Department of Labour and National Service operates the Commonwealth Employment Service, which provides employment service facilities, free of cost, to management and employees. The use of the Service to obtain positions or engage labour is purely voluntary. Special facilities are available for certain classes of workers, such as the physically handicapped, youths, professional and semi-professional workers and migrants. A Research

BRANCHES:

Officer in Charge,
Defence Research Laboratories,
New South Wales Division,
P.O. Box 60,
ALEXANDRIA. N.S.W.

Officer in Charge,
Defence Research Laboratories,
South Australian Branch,
C/o Post Office,
WOODVILLE. S.A.

The Standards Association of Australia,
Science House, Essex and Gloucester Sts.,
Sydney, N.S.W.:

This Association was established under the aegis of the Commonwealth and State Governments for the promotion of standardisation and simplified practice. In conjunction with industrialists and appropriate organisations it draws up national standard specifications for materials and products.

The National Association of Testing Authorities, Kembla Buildings, Margaret Street,
Sydney, N.S.W.

This is a combined Commonwealth and State Government organisation with representatives from appropriate industrial organisations. It aims at providing a testing service for government, industry and commerce, to enable manufactured products to be tested for conformity with recognised standards of quality, thus maintaining a high standard of quality and performance.

Branch has up-to-the-minute labour market information available for employers and others who require it. The Commonwealth Employment Service has about 100 District Employment Offices and some 250 Agencies throughout Australia, which are situated in the capital cities and their suburbs and most of the larger provincial towns. Skilled employment officers of the Commonwealth Employment Service aim at referring the right person to the right job. The Service reduces greatly time lost by employees in seeking work, and advertising and other expenses incurred by employers in connection with staff recruitment.

(b) The Industrial Relations and General Division has a general concern with the maintenance of industrial peace. It supplies information and advice on awards (the wages, hours and working conditions of the majority of Australian workers are governed by awards of industrial tribunals) and industrial matters, and publishes monthly the "Industrial Information Bulletin", an authoritative digest of all the important decisions of industrial tribunals, Commonwealth and State; it also contains other matters of interest in the industrial relations field, e.g., providing a ready means of discovering the current basic wages for workers under both Federal and State awards in any part of Australia.

(c) The Industrial Welfare Division provides a reference authority for Commonwealth departments and industry generally on good personnel practice and physical working conditions. Based on a programme of applied research into problems of personnel administra-

tion and those factors affecting physical working conditions such as safety, lighting, industrial hygiene, and ventilation, and industrial building design, it makes authoritative information available through its direct advisory service to industry and through technical publications on a wide range of topics in these fields. The Division provides technical advice and assistance on the establishment and operation of industrial food services, in addition to operating cafeterias in government departments and on the waterfront. The Division is also responsible for the control and administration of the Commonwealth Arbitration Inspectorate.

(d) The Industrial Training Division's responsibilities include the control and supervision of all forms of vocational and professional (other than university) types of training under the Commonwealth Reconstruction Training Scheme; and the pre-vocational instruction and vocational training of disabled persons under the Commonwealth's Social Service Scheme for training of the disabled. The Division provides a reference authority on techniques and methods of technical and vocational training and is responsible for the development and introduction of industry training.

STATE GOVERNMENT ACTIVITIES

The various State Governments each maintain authorities whose functions include the encouragement and expansion of secondary industries within their respective States.

Decentralisation has been, since the conclusion of the 1939-45 War, the accepted policy both of the Commonwealth and State Governments, and has for its aim not only to encourage industries in those States which have hitherto been relatively lacking in manufacturing enterprises, but also to achieve more equitable distribution of secondary industries throughout the country areas of those States in which large concentrations of industries have developed in the capital cities.

There is close collaboration between the Commonwealth and the respective States in regard to matters of common interest affecting manufacturing development, and the Commonwealth Department of National Development through its Division of Industrial Development works in close accord with State authorities in pursuing common aims.

New South Wales

In November, 1941, the State Government set up the Decentralisation Advisory Committee to report on questions of State development in relation to secondary industries. After the war, a Secondary Industries Division was formed as part of the State Department of Labour and Industry and Social Welfare. The Division later became absorbed by the Department of Secondary Industries and Building Materials.

The State Department's functions covered decentralisation of industry, control over building operations and the distribution of building materials, assistance to expand and establish industries, and the establishment of new industries.

In addition, the Department was in a position to provide technical advice on issues relating to operations and to arrange for research to be carried out by the New South Wales Uni-

(e) The Migrant Workers' Accommodation Division is responsible for the provision, operation and maintenance of hostels for the housing of migrant workers and their dependants. The Division has established a chain of hostels throughout Australia at points where the services of the migrant workers can be most effectively used in industry. As from February, 1952, these activities were undertaken by a newly formed company, the Commonwealth Hostels Ltd., which works under the direction of the Minister of Labour and National Service, and in collaboration with his Department.

Enquiries on labour matters may be sent to—

HEADQUARTERS:

The Secretary,
Department of Labour and National Service,
Box 2817AA, G.P.O.,
MELBOURNE, VIC.

CAPITAL CITY, EACH STATE:

The Regional Director,
Employment Division,
Department of Labour and National Service.

versity of Technology on any aspect of industrial production.

The Department was recently abolished. The Secondary Industries section of the Department has been transferred to the Premier's Department.

Victoria

In Victoria the Regional Planning and Decentralisation Division of the Premier's Department is responsible, inter alia, for the promotion of industrial development in non-metropolitan areas of the State. Working in close liaison with other State Government departments, the Division is able to advise industrialists on suitable locations for their industries, having regard to labour requirements and other matters, and to facilitate negotiations for factory sites and the provision of housing for employees, as well as of various utility services.

Grants of Crown lands may be made for the purpose of assisting the establishment of industries in rural and urban districts outside the metropolitan area of Melbourne, both as sites for industrial undertakings and for the erection of housing for the employees.

By arrangement with the Housing Commission (Victoria) an endeavour is made to anticipate the housing needs of employees of new industries by the inclusion of such additional houses in the programmes laid down by the Commission for the country districts concerned.

To assist in assessing the developmental possibilities of the various regions of the State, detailed economic surveys are being made of the resources and development of each. The results of these surveys are available for the guidance of industry.

The Decentralisation Division also assists industrial development in many other ways, as for example—

with advice on the availability of suitable buildings;

with technical advice on alterations to existing buildings, and introductions to builders;

by arranging for freight concessions between Melbourne and the decentralised locations;

by assisting in the construction of roads to serve new industries;

by arranging to expedite the supply of electric power;

with advice regarding industrial requirements of Victorian factory legislation, etc.; by introductions to prospective clients; and by co-operation with existing firms or specialists in the use of idle machinery or partly employed plant, etc.

Through the Rural Finance Corporation further encouragement is given the establishment of new country industries by the making of advances by way of loan at the lowest possible rates of interest. As in the case of grants of land, such advances may be made both to assist in the establishment of the industry itself and in the provision of housing for its employees.

Queensland

The Queensland Government has, pursuant to "The Labour and Industry Act of 1946", established the Secondary Industries Division with the general objective of prompting the development of secondary industries within the State especially in regard to decentralisation of such industries.

The Division is well equipped to render technical, commercial and accountancy assistance to industries, and the technical officers of all Government departments are available for the same purpose.

The Industries Assistance Board which also operates under the Act provides for the rendering of financial assistance to industries which cannot obtain finance from banks or other financial institutions. The Board comprises the director, as chairman, and representatives of other Government departments and outside commercial organisations.

Close liaison and co-operation are maintained with the Commonwealth Division of Industrial Development in all matters regarding the industrial development of the State.

South Australia

Under the provisions of the Industries Development Act 1941-49, authority is given, inter alia, to assist and encourage the establishment of secondary industries outside the metropolitan area. This legislation provided for the appointment of the Industries Development Committee whose functions in 1943 were amended to include submission to the Treasurer of recommendations for loans or grants from the Country Secondary Industries Fund. In addition, the Committee is charged with the responsibility of providing relevant information to assist persons and organisations contemplating or increasing industrial production in decentralised areas.

The 1943 amendment made provision for the payment of the sum of £100,000 into the Country Secondary Industries Fund from surplus revenue derived by the State in the 1942-43 financial year. The Fund also includes monies received by the Treasurer in payment of principal or interest on loans made to industrialists under the Act and any other sums appropriated to it by State Parliament. The

Committee may make loans to persons from this Fund to assist in establishing industries outside the metropolitan area, or for the purposes of research.

Further amendments to the Act were made in 1947 and 1949 to permit the grant of loans from general revenue, to persons engaged or proposing to engage in the production of building materials.

As well as the Industries Development Committee, there is in South Australia a South Australian Industries Advisory Committee, which was originally set up at the request of the Secondary Industries Commission of the Commonwealth to work at the State level on the post-war development and expansion of industry and to provide with the Commission itself the machinery for Federal/State contact in the decentralisation of Australia's manufacturing potential. Officers of the South Australian Industries Advisory Committee provide valuable information to manufacturers both on technical and other matters and centralise the information required by industrialists investigating the potential of the Australian market and the location of an Australian factory to support that market. The Committee provides a central office for the ironing out of the problems, not only of new industries, but also of expanding industries, which inevitably occur in times of shortages and of Government controls. In South Australia, the Deputy Director of the Commonwealth Division of Industrial Development is Chairman of the South Australian Industries Advisory Committee; the liaison effected through this merging of both Commonwealth and State Departments has been of immeasurable benefit to the State during the important postwar period.

Western Australia

Through its Department of Industrial Development, which in its present form, was set up in 1941, the State Government is continuing to take active steps to encourage and assist in every possible way the growth of secondary industries in Western Australia. Assistance is rendered in the selection of suitable sites, with the desirability of decentralisation in mind, by facilitating transactions with Government departments and public authorities, the provision of technical advice and information as to the availability of natural resources. In special cases where it is a matter of policy to establish a new industry, or to increase production where the State is under-supplied, financial assistance may be given by means of guaranteed bank overdraft.

With a view to encouraging development generally, and also where possible to bringing about a better distribution of industry, four Zone Development Committees have been established. They are based on Albany, Geraldton, and the South West and Central divisions. These bodies are responsible, inter alia, for development of their zones' resources and, by co-operation with and assistance to secondary industry, encourage its establishment in these zones.

Tasmania

The encouragement of the establishment in Tasmania of new secondary industries of any size or type is a policy of the Tasmanian Government. To sustain this policy the Department of Industrial Development has been established, designed to promote and assist industrial expansion.

Due to the State's compactness, its potential and developed power supplies and mineral resources, industry is well distributed and to date the need for decentralisation has not presented itself as a major problem. Particular stress has been placed on attracting industries

from the mainland and overseas. The provision of certain concessions, however, has in some measure enabled the Government to sponsor a well-balanced development of the State's secondary industries.

DIVISION OF INDUSTRIAL DEVELOPMENT

The Division of Industrial Development in the Department of National Development is a Commonwealth instrumentality entrusted with

the task of encouraging the development of manufacturing industry in Australia, in regard to both economic and technical aspects.

EXPORT

The Department of Commerce and Agriculture is responsible for all matters of Government administration relating to export.

Apart from a very close liaison with all agricultural and pastoral marketing organisations (achieved mainly through producer/merchant/Government committees or boards) the Department has three main branches of interest to manufacturers. These are the Trade Promotion Section, Trade Relations Section, and the Trade Commissioner Service.

The Trade Promotion Section serves as an overseas market research agent to manufacturers seeking export outlets, making available market and commodity surveys, general trade intelligence reports and legislative or regulatory changes in domestic and foreign import and export controls. It distributes a journal to manufacturers, for this purpose.

The Trade Relations Section, as its name implies, negotiates tariff and trade agreements with foreign countries in concert with other

Australian Government and private organisations.

The Trade Commissioner Service also acts (in effect) as a confidential overseas agent for Australian manufacturers, assisting in negotiations between parties and promoting companies' interests abroad. These services are rendered in conjunction with the Trade Promotion Section, and if necessary cover import as well as export matters. An associated Trade Publicity Section provides overseas publicity opportunities to Australian manufacturers, displaying their export products in overseas exhibitions, and arranging publicity in trade and metropolitan press, film screenings and other media.

Enquiries on all export matters may be sent to:

The Director,
Trade Promotion,
Department of Commerce and Agriculture,
Reliance House,
301 Flinders Lane,
MELBOURNE, C.1. VIC.

GENERAL NOTE REGARDING IMMEDIATE POLICY ON INDUSTRIAL EXPANSION

Developing pressure on resources in recent years, together with the threatening international outlook has resulted in the policy of the Commonwealth Government towards industrial expansion becoming one of discriminatory support. As a general policy investment is now encouraged only in the fields of basic national development and of defence preparedness. This policy is, of course, under continuous review.

The major steps which so far have been taken in this direction are—

the establishment of the National Security Resources Board;

the announcement by the Commonwealth Bank of a restrictive advances policy for trading banks (eased in October, 1952);

the re-introduction of close scrutiny of new issues of capital by the Capital Issues Control Board;

the passing of the Defence Preparations Act.

The National Security Resources Board was set up for the investigation of problems in connection with the conversion of the Australian economy to defence preparedness. Its functions are to consider and make recommendations on labour and material supply shortages; on the effect of the expansion of the Armed Services on manufacturing indus-

tries; on problems of stock-piling; and on the place of women in the national effort.

Nine Commonwealth/State Consultative Committees have been set up to consider various matters of great urgency. They are as follows—

Electric Power
Transport
Rail Transport
Road Transport
Sea Transport
Water Conservation and Supply
Coal
Allocation of Materials
Diversion of Essential Resources to Luxury Production

The Commonwealth Bank, with the authority of the Commonwealth Treasurer, issued a directive in November, 1950, that finance for capital expenditure and permanent non-fluctuating working requirements should be obtained outside the banking system. Only fluctuating operating requirements should be provided by bank overdraft. This policy should be applied to both new and existing advances. Advances are not to be granted to hire-purchase and cash-order businesses, nor for speculative buying or holding of commodities. Exceptions from this rule are all activities which promote the production of coal, steel, gas or other important industrial materials.

Banks are also permitted to depart from these directions where a lag of output of an enterprise would cause a drop in production over a wide range of industry. These banking controls were virtually removed in October, 1952.

Effective control over capital issues was re-introduced in February, 1951. Regulations were further tightened in June, 1951. Companies desiring to raise by a new share issue more than £10,000 in any period of two years are now required to obtain the consent of the Commonwealth Treasurer. This approval may not be forthcoming if the Board considers that the expansion of the company is not in accordance with the Government's policy to channel investment into those projects which have a high defence priority.

The maximum amount which a company may borrow without consent by mortgage,

debentures, unsecured loan and deposit is limited to £5,000 in any twelve months' period. Any sum borrowed in this way has the effect of reducing the maximum amount of capital that can be raised by other means.

The broad objective of capital issues control is to give priority to defence needs and to ensure concentration upon vital national tasks of development. (This control was unsuccessfully challenged in the High Court.)

The Defence Preparations Act of August, 1951, is designed to enable quick and flexible action to be taken by regulation for speeding up Australia's defence preparedness. The Commonwealth Government intends to solicit voluntary co-operation to this effect in the first place, but may use the compulsory powers conferred on it by the Act, should this become necessary.

Appendix III:

STATISTICAL SUMMARIES

FIRST SUMMARY: Total Population and Permanent Migration Movement, 1939, 1949-51

SECOND SUMMARY: Australia Overall (Selective Summary), 1881 to 1950

THIRD SUMMARY: Number of Wages and Salary Earners, Male, Female, and Total, in Broad Categories of Occupation, 1939, 1949, 1950, 1951

FOURTH SUMMARY: Basic Statistics, Manufacturing Industries (totals of tables of each Part Three, this study), 1938-39, 1949-50, June 1950, September 1951

FIFTH SUMMARY: National Income and Expenditure, 1938-39 to 1950-51

SIXTH SUMMARY: Index of Prices and Wages, 1936-37/1938-39 to 1951-52

SEVENTH SUMMARY: Value of Imports and Exports, in Broad Categories, 1938-39, 1950-51, 1951-52

First Summary

TOTAL POPULATION AND PERMANENT MIGRATION MOVEMENT, 1939, 1949-51

Year	Population (excluding full-blood aborigines) at end of year	Permanent Migration Movement		
		Arrivals	Departures	Net Migration
1939	7,004,912	24,068	11,541	12,527
1945	7,430,197	7,512	10,785	-3,273
1946	7,517,981	18,217	29,806	-11,589
1947	7,638,628	31,765	19,579	12,186
1948	7,794,889	65,739	17,271	48,468
1949	8,050,882	167,727	18,457	149,270
1950	8,315,791	174,540	20,855	153,685
1951	8,431,391	132,542	22,180	110,362

Second Summary

AUSTRALIA OVERALL (Selective Summary), 1881 to 1950

Item	1881	1891	1901	1911	1921	1931	1941	1950
Population (a)—Males	1,247,059	1,736,617	2,004,836	2,362,232	2,799,462	3,332,577	3,598,644	4,196,640
Females	1,059,677	1,504,368	1,820,077	2,191,554	2,711,532	3,220,029	3,544,954	4,119,151
Total	2,306,736	3,240,985	3,824,913	4,553,786	5,510,994	6,552,606	7,143,598	8,315,791
Marriages—Number	17,244	23,862	27,753	39,482	46,869	38,882	75,148	75,599
Rate	7.60	7.47	7.32	8.79	8.59	5.96	10.57	9.24
Births—Number	80,004	110,187	102,945	122,193	136,198	118,509	134,525	190,591
Rate	35.26	34.47	27.16	27.21	24.95	18.16	18.92	23.29
Deaths—Number	33,327	47,430	46,330	47,809	54,076	50,560	71,176	78,187
Rate	14.69	14.84	12.22	10.66	9.91	8.67	10.01	9.55
Agriculture—	1881-82	1891-92	1901-02	1911-12	1921-22	1931-32	1941-42	1950-51 (b)
Wheat—Area .. '000 acres	2,996	3,335	5,116	7,428	9,719	14,741	12,003	11,663
Yield .. '000 bus.	21,444	25,675	38,562	71,636	129,089	190,612	166,713	184,244
Average yield .. bus.	7.16	7.70	7.54	9.64	13.28	12.93	13.89	15.80
Oats—Area .. '000 acres	195	246	461	617	733	1,085	1,460	1,757
Yield .. '000 bus.	4,796	5,726	9,790	9,562	12,147	15,195	22,302	25,128
Average yield .. bus.	24.62	23.27	21.22	15.50	16.56	14.00	15.27	14.30
Barley—Area .. '000 acres	76	68	75	116	299	342	784	1,079
Yield .. '000 bus.	1,353	1,179	1,520	2,057	6,086	6,291	18,004	22,841
Average yield .. bus.	17.84	17.31	20.40	17.66	20.36	18.37	22.96	21.17
Maize—Area .. '000 acres	166	284	295	340	305	269	301	170
Yield .. '000 bus.	5,726	9,262	7,035	8,040	7,840	7,062	7,436	4,729
Average yield .. bus.	34.54	32.56	23.86	26.29	25.69	20.21	24.67	27.85
Hay—Area .. '000 acres	768	942	1,088	2,518	2,995	2,635	2,758	1,377
Yield .. '000 tons	767	1,067	2,025	2,868	3,902	3,167	3,575	2,063
Average yield .. tons	1.00	1.13	1.20	1.14	1.30	1.20	1.30	1.50
Potatoes—Area .. '000 acres	(c) 76	113	110	130	149	145	99	127
Yield .. '000 tons	(c) 243	380	323	301	388	397	333	412
Average yield .. tons	(c) 3.19	3.37	2.94	2.31	2.60	2.74	3.35	3.24
Sugar-cane—Area (d) '000 acres	20	45	87	101	128	242	255	272
Yield .. '000 tons	350	738	1,368	1,682	2,437	4,213	5,154	7,052
Av. yield .. tons	17.74	16.23	15.73	16.65	18.99	17.44	20.25	25.94
Vineyards—Area .. '000 acres	15	49	64	61	92	113	130	137
Wine .. '000 gal.	1,438	3,438	5,262	4,975	8,543	14,191	16,045	27,159
Total net value of all agricultural production .. £'000	(e) 15,519	(e) 16,088	(c) 23,835	(e) 38,774	(e) 81,890	49,714	62,695	(k) 100,230
Pastoral, Dairying, etc.—								
Live Stock—Horses .. '000	1,088	1,585	1,620	2,278	2,438	1,776	1,611	999
Cattle .. '000	8,011	11,112	8,491	11,829	14,441	12,261	13,561	15,229
Sheep .. '000	65,093	106,421	72,040	96,886	86,119	110,610	125,189	115,546
Pigs .. '000	703	846	931	1,111	960	1,168	1,477	1,134
Wool production (f) .. '000 lb.	(h) 319,649	(h) 634,046	(h) 539,395	(h) 798,391	723,059	1,007,455	1,167,158	1,092,000
Butter production .. tons	(g)	(h) 18,891	(h) 46,316	(h) 94,676	(h) 119,228	174,665	167,631	164,971
Cheese production .. tons	(g)	(h) 4,523	(h) 5,288	(h) 7,092	(h) 14,577	14,028	30,143	44,578
Meat (i)—								
Beef and Veal .. tons					339,495	349,835	533,502	632,109
Mutton and Lamb .. tons					218,381	307,277	371,726	276,878
Pork .. tons					11,060	22,746	58,086	34,134
Bacon and Ham .. tons					26,173	31,751	42,464	37,297
Total .. tons	(g)	(h) 7,487	(h) 15,188	(h) 23,810	608,196	727,484	1,027,010	1,013,841
Total net value of—								
Pastoral production .. £'000	e 29,538	(e) 39,256	(e) 30,890	(c) 72,883	119,471	43,025	85,359	(k) 342,988
Dairying production .. £'000						22,564	34,343	(k) 81,102
Mineral Production—	1881	1891	1901	1911	1921	1931	1941	1949
Gold .. £'000	5,194	5,282	14,018	10,552	4,019	3,564	15,991	10,812
Silver and Lead .. £'000	46	3,736	2,249	3,022	1,540	1,444	6,256	20,275
Copper .. £'000	714	367	2,215	2,564	804	568	1,505	2,077
Tin .. £'000	1,146	561	448	1,210	418	216	1,001	1,082
Zinc .. £'000	—	3	4	1,415	283	513	1,590	7,107
Coal (Black and Brown) .. £'000	638	1,912	2,603	3,927	11,015	6,194	11,064	22,171
Total value of all mineral production .. £'000	7,820	12,074	21,817	23,303	20,029	13,191	41,690	67,770

(Table is continued on next page)

Item	1881	1891	1901	1911	1921-22	1931-32	1941-42	1950-51 (b)
Forestry Production—								
Quantity of local timber sawn— .. '000 sup. ft.	(g)	(g)	452,181	604,794	590,495	236,707	913,075	(k)1,223,060
Factories—								
Number of factories	(j)	(j)	(j)	14,455	18,023	21,657	26,971	43,129
Hands employed no.				311,710	378,540	336,658	725,342	968,232
Wages paid £'000				27,528	68,051	55,932	180,052	491,363
Value of production .. £'000				51,259	121,674	110,982	316,438	845,662
Total value of output .. £'000				133,022	320,341	281,646	773,059	2,151,053
								1950-51
Shipping—								
Oversea vessels—Entrances and Clearances no.	3,284	3,778	4,028	4,174	3,111	3,057	2,544	3,903
.. .. '000 tons	2,549	4,726	6,542	9,985	9,081	11,396	10,768	17,307
Commerce—								
Imports—Oversea £'000 f.o.b.	26,480	34,355	38,657	61,008	93,893	51,789	173,593	743,871
Per head £ s. d.	11/13/5	10/15/0	10/4/0	13/11/7	17/0/9	7/18/1	24/6/0	89/10/0
Exports—Oversea £'000 f.o.b.	27,528	36,043	49,696	79,482	127,847	108,404	168,977	981,796
Per head £ s. d.	12/2/7	11/5/6	13/2/2	17/13/11	23/4/0	16/10/11	23/13/1	118/2/6
Total—Oversea trade £'000								
f.o.b.	54,008	70,398	88,353	140,490	221,740	160,193	342,570	1,725,667
Per head £ s. d.	23/16/0	22/0/6	23/6/2	31/5/6	40/4/9	24/9/0	47/19/1	207/12/6
Net Customs and Exise duties £'000	4,809	7,441	8,657	13,515	27,565	28,525	55,700	164,991
Per head .. £ s. d.	2/2/5	2/6/7	2/5/8	2/19/2	5/0/1	4/7/1	7/15/11	19/17/0
Principal Oversea Exports (l)—								
Wool—Quantity (m) '000 lb.	329,200	640,753	528,889	734,327	945,931	903,488	937,685	1,184,092
Value .. £'000 f.o.b.	13,173	19,940	15,237	26,071	47,977	32,102	58,041	633,298
Wheat—Quantity '000 bus.	5,365	9,795	20,260	55,148	99,947	127,401	22,313	86,782
Value .. £'000 f.o.b.	1,190	1,939	2,775	9,642	28,644	19,220	4,645	74,151
Flour—Quantity '000 short tons	50	33	97	176	360	611	414	883
Value .. £'000 f.o.b.	520	328	590	1,392	5,520	3,833	4,191	32,894
Butter—Quantity '000 lb.	1,299	4,240	34,536	101,722	127,347	201,639	130,347	120,031
Value .. £'000 f.o.b.	39	207	1,448	4,637	7,968	10,250	8,125	18,469
Hides and skins £'000 f.o.b.	317	874	1,251	3,227	3,137	2,316	5,982	27,213
Tallow, inedible £'000 f.o.b.	644	571	678	1,936	1,442	831	842	1,322
Meats £'000 f.o.b.	363	461	2,611	4,303	5,542	6,370	14,094	30,390
Timber (undressed) £'000 f.o.b.	118	38	639	1,024	1,158	500	320	1,107
Gold £'000 f.o.b.	6,445	5,704	14,316	12,046	3,483	11,893	9,188	—
Silver and Lead £'000 f.o.b.	58	1,932	2,250	3,213	2,697	2,902	7,434	25,045
Copper £'000 f.o.b.	677	418	1,619	2,346	705	472	18	95
Coal £'000 f.o.b.	361	646	987	901	1,100	342	259	243
Government Railways—								
Length of line open .. miles	3,832	9,541	12,579	16,078	23,502	26,959	27,241	26,955
Capital cost £'000	42,741	99,764	123,224	152,195	244,353	(n)321,972	(o)322,152	(u)374,184
Gross revenue £'000	3,910	8,654	11,038	17,848	38,195	37,580	66,482	105,644
Working expenses .. £'000	2,142	5,630	7,134	10,946	29,818	28,142	51,043	112,777
Per cent. of working expenses on gross revenue .. %	54.77	65.06	64.63	61.33	78.07	74.88	76.78	106.75
Postal—								
Letters and post-cards dealt with '000	67,640	157,297	220,853	453,063	561,973	(p)731,135	921,901	1,228,285
per head no.	29.61	49.07	58.26	100.90	102.01	(p) 111.62	129.17	147.78
Newspapers dealt with '000	38,063	85,280	102,727	141,638	140,477	139,502	(p)177,974	(p) 257,384
Newspapers per head .. no.	16.66	26.61	27.10	31.54	25.50	21.30	(p) 24.94	(p) 30.97
Cheque-paying Banks(q)—								
Note circulation .. £'000	3,979	4,388	3,399	3,718	(r) 214	197	167	158
Coin and bullion held .. £'000	9,108	17,482	19,781	33,471	21,627	1,949	1,533	3,273
Advances £'000	57,733	129,742	86,353	108,579	193,436	227,139	269,944	502,429
Deposits £'000	53,849	97,691	91,487	143,447	(s) 273,867	276,114	386,502	1,276,738
Savings Banks (t)—								
Total deposits £'000	7,172	14,833	30,883	59,394	154,396	197,966	274,275	837,444
Average per head of population £ s. d.	3/3/3	4/12/10	8/3/0	13/8/5	28/0/4	30/1/11	38/3/11	99/6/6
					1921	1931	1941	1949
State Schools—								
Schools no.	4,494	6,231	7,012	8,060	9,445	10,097	9,535	7,874
Teachers no.	9,028	12,564	14,500	16,971	26,120	33,762	32,066	34,090
Net enrolment no.	432,320	561,153	638,478	638,850	819,042	936,901	886,655	970,632
Average attendance .. no.	255,143	350,773	450,246	463,799	666,498	817,262	732,116	810,800

(a) At 31st December. (b) Subject to revision. (c) Partly estimated. (d) Productive cane. (e) Gross value.
 (f) In terms of greasy. (g) Not available. (h) Year ended December. (i) Bone-in Weight—in terms of fresh meat;
 bacon and ham—cured weight. (j) Owing to variation in classification, effective comparison is impossible. (k) 1949-50.
 (l) Australian produce except gold, which includes re-exports. (m) In terms of greasy. (n) Between 1st July, 1927, and
 30th June, 1932, the capital account was reduced by £31,000,000. (o) Between 1st July, 1936 and 30th June, 1938, the
 capital account was reduced by £30,000,000. (p) Includes packets. (q) Figures for first year are average for the
 December quarter, the remainder for the June quarter. All cheque-paying banks prior to 1931-32, private trading banks
 only thereafter. (r) Decrease due to prohibition of re-issue. (s) Includes Commonwealth Savings Bank deposits.
 (t) First three columns at 31st December; remainder 30th June. (u) 1949-50.

Third Summary

NUMBER OF WAGES AND SALARY EARNERS, Male, Female, and Total, in Broad Categories of Occupation, 1939, 1949, 1950, 1951

Industrial Grouping	July, 1939	May, 1949 (a) (b)	June, 1950 (a)	Sept., 1951 (a)
MALES:				
Forestry, Fishing and Trapping	'000 24.1	'000 28.5	'000 28.5	'000 28.0
Mining—				
Gold	15.4	8.6	8.9	8.4
Silver, Lead	6.4	7.8	8.4	9.2
Coal	22.1	26.4	26.9	27.7
Other (incl. Quarries)	8.3	9.5	9.7	10.4
Total, Mining and Quarrying	52.2	52.3	53.9	55.7
Manufacturing, etc.—				
Factories (c)	391.5	635.9	659.0	674.0
Other (d)	64.6	56.7	57.4	58.6
Total, Manufacturing	456.1	692.6	716.4	732.6
Building and Construction—				
Building (Privately Employed) (e)	} 149.7	90.4	93.0	101.5
Other (f) (g)		90.5	104.2	112.3
Total, Building and Construction	149.7	180.9	197.2	213.8
Transport and Communication—				
Road Transport	50.2	84.2	85.9	84.7
Shipping and Stevedoring	35.0	46.0	48.4	48.7
Rail and Air Transport	73.0	99.1	100.9	101.2
Communication	27.7	52.4	57.6	55.7
Total, Transport, etc.	185.9	281.7	292.8	290.3
Property and Finance (including Banks and Insurance)	47.1	51.3	52.9	54.7
Commerce—				
Wholesale Trade	} 212.6	97.9	104.1	112.4
Primary Produce Agencies		20.7	21.0	22.7
Retail Trade		125.6	127.1	128.7
Total, Commerce	212.6	244.2	252.2	263.8
Public Authority Activity, n.e.i.	31.8	87.3	92.3	96.9
Other—				
Law and Order	17.6	18.1	18.5	18.7
Religion and Social Welfare	10.2	11.4	11.4	11.4
Health Services	17.8	24.7	24.8	24.8
Education	22.1	29.7	30.7	32.2
Other Professional	11.5	11.6	11.9	12.2
Entertainment, Sport	17.4	18.4	18.0	18.1
Personal Service (h)	37.0	54.4	55.9	54.0
Total, Other	133.6	168.3	171.2	171.4
New Australians employed by Defence Authorities (g)	—	—	1.3	0.2
TOTALS, MALES	1,293.1	1,787.1	1,858.7	1,907.4
FEMALES:				
Forestry, Fishing and Trapping	0.1	0.1	0.2	0.2
Mining and Quarrying	0.3	0.7	0.7	0.8
Manufacturing, etc.—				
Factories (c)	148.2	215.6	223.8	235.5
Other (d)	20.8	6.3	6.6	6.8
Total, Manufacturing	169.0	221.9	250.4	242.2
Building and Construction	1.2	3.1	3.3	3.9
Transport and Communication—				
Road Transport	1.5	7.3	7.9	8.6
Shipping and Stevedoring	1.2	2.2	2.2	2.4
Rail and Air Transport	2.5	8.0	8.0	8.4
Communication	7.4	19.5	20.7	20.1
Total, Transport, etc.	12.6	37.0	38.8	39.5
Property and Finance (including Banks and Insurance)	13.5	26.0	28.1	31.6
Commerce—				
Wholesale Trade	} 101.4	29.3	31.8	36.0
Primary Production Agencies		4.5	4.9	5.5
Retail Trade		111.1	113.3	118.5
Total, Commerce	101.4	144.9	150.0	160.0

Industrial Grouping										July, 1939	May, 1949 (a) (b)	June, 1950 (a)	Sept., 1951 (a)
FEMALES (continued)													
Public Authority Activity, n.e.i.										10.0	24.8	25.5	27.1
Other—													
Law and Order										4.0	8.1	8.1	8.6
Religion and Social Welfare										7.0	9.0	9.0	8.9
Health Services										34.0	62.0	65.0	67.8
Education										32.0	37.7	39.1	40.3
Other Professional										5.0	8.7	8.8	9.4
Entertainment, Sport										4.0	8.8	8.4	8.7
Personal Service (h)										43.0	71.3	72.8	71.7
Total, Other										129.0	205.6	211.2	215.4
TOTALS, FEMALES										437.1	664.1	688.2	720.8
PERSONS:													
Forestry, Fishing and Trapping										24.2	28.6	28.7	28.2
Mining—													
Gold										15.5	8.8	9.1	8.5
Silver, Lead										6.5	7.9	8.6	9.4
Coal										22.2	26.6	27.0	27.9
Other (incl. Quarries)										8.3	9.7	9.9	10.7
Total, Mining and Quarrying										52.5	53.0	54.6	56.5
Manufacturing, etc.—													
Factories (c)										539.7	851.5	882.8	909.5
Other (d)										85.4	63.0	64.0	65.4
Total, Manufacturing										625.1	914.5	946.8	974.9
Building and Construction—													
Building (Privately Employed) (e)										150.9	93.1	95.8	104.0
Other (f) (g)											90.9	104.7	113.7
Total, Building and Construction										150.9	184.0	200.5	217.7
Transport and Communication—													
Road Transport										51.7	91.5	93.8	93.3
Shipping and Stevedoring										36.2	48.2	50.6	51.1
Rail and Air Transport										75.5	107.1	108.9	109.6
Communication										35.1	71.9	78.3	75.8
Total, Transport, etc.										198.5	318.7	331.6	329.8
Property and Finance (including Banks and Insurance)										60.6	77.3	81.0	86.3
Commerce—													
Wholesale Trade										314.0	127.2	135.9	148.4
Primary Produce Agencies											25.2	25.9	28.2
Retail Trade											236.7	240.4	247.2
Total, Commerce										314.0	389.1	402.2	423.8
Public Authority Activity, n.e.i.										41.8	112.1	117.8	124.0
Other—													
Law and Order										21.6	26.2	26.6	27.3
Religion and Social Welfare										17.2	20.4	20.4	20.3
Health Service										51.8	86.7	89.8	92.6
Education										54.1	67.4	69.8	72.5
Other Professional										16.5	20.3	20.7	21.6
Entertainment, Sport										21.4	27.2	26.4	26.8
Personal Service (h)										80.0	125.7	128.7	125.7
Total, Other										262.6	373.9	382.4	386.8
New Australians Employed by Defence Authorities (g)										—	—	1.3	0.2
TOTALS, PERSONS										1,730.2	2,451.9	2,546.9	2,628.2

- (a) All figures for the months subsequent to May 1945, are subject to revision on the basis of results of the Census of 30th July 1947 (except for factories, for which figures to June 1948 are final).
- (b) Figures for June 1949 showed some of the effects of the Australia-wide black-coal dispute which commenced on 27th June, and ended 15th August 1949, and figures for May have therefore been substituted for purposes of annual comparison.
- (c) Refers to estimated employment in factories as defined for the purpose of the annual production census, results of which are published annually in the Production Bulletin, Part I, "Secondary Industries". In this connection, a factory is defined as an industrial establishment in which four or more hands are employed or in which power other than hand is used. The employees covered are those engaged in manufacturing activities and exclude those engaged in selling and distribution, etc.
- (d) Includes employees in industrial establishments outside the scope of the definition of a factory (given in (c) above) and persons employed by factory proprietors but engaged in selling or distribution, etc., who are excluded from figures shown opposite "Factories".
- (e) Includes employees of private employers contracting to public authorities.
- (f) Includes employees on construction of roads, bridges, earthworks, etc. and employees directly employed by public authorities on building and maintenance of buildings.
- (g) "New Australians" temporarily employed by Defence authorities are now included in a separate group instead of being shown under Building and Construction as previously. ("New Australians" are migrants.)
- (h) Includes hotels, restaurants, hairdressing and other personal service (except female private domestic).

Fourth Summary

BASIC STATISTICS, MANUFACTURING INDUSTRIES (totals of tables of Part Three of each chapter, this study), 1938-39, 1949-50, June 1950, September 1951

COMPARATIVE STATISTICS, 1938-39/1949-50

NUMBER OF ESTABLISHMENTS AT 1938-39 AND 1949-50

NUMBER OF EMPLOYEES AT 1938-39, 1949-50, JUNE 1950, SEPTEMBER 1951

Industries Grouping (a)	Number of Establishments		Number of Employees			
	1938-39	1949-50	1938-39	1949-50	June 1950 (b)	Sept. 1951 (b)
	no.	no.	no.	no.	no.	no.
Fuels, Lubricants, Light, Power ..	546	520	11,003	16,774	14,841	15,491
Products of Crude and Treated Non-metallic Minerals ..	1,048	1,695	25,173	31,587	35,303	36,691
Timber Preparation, Products of Wood, Cane, Bark, Cork, Straw ..	3,809	(c) 6,416	45,199	72,412	62,415	62,754
Pulp, Paper, Paperboard ..	7	14	1,961	6,160	6,125	7,425
Paper Products, Printing, Signwriting, Photographic Materials ..	1,807	2,027	37,904	48,896	47,227	47,804
Chemical and Associated Industries ..	564	867	17,369	30,126	30,933	33,225
Plastics Products ..	(d) 198	198	(d) 5,169	5,169	4,976	(e) 4,500
Rubber Products, Reconditioning of Tyres	299	404	7,502	12,382	13,010	13,550
Metals, Shapes, Pipes, Tubes, Castings, Forgings ..	642	895	30,005	41,314	44,759	45,366
Transport Equipment ..	4,034	5,987	73,411	137,418	131,016	135,334
Electrical and Electronic Products ..	432	940	15,494	40,239	43,030	44,998
Machinery, Plant, Equipment, Apparatus, Not Elsewhere Included ..	2,775	5,836	67,666	141,814	138,514	146,634
Food and Refrigeration, Animal Foods, Beverages, Tobacco ..	5,240	6,860	84,635	124,046	115,935	116,325
Leathers, Woolled Skins, and Products ..	395	622	9,381	15,351	15,086	13,235
Textiles, Felting, Cordage ..	178	479	26,079	41,649	40,405	42,221
Clothing, Manchester, Napery, Footwear	4,766	7,246	105,863	141,349	131,302	136,546
Products of Textiles and/or Wastes, Cordage, Hair, Felt, Not Elsewhere Included	358	586	5,281	7,975	7,488	(e) 7,384
Totals, Manufacturing Industries ..	26,900	41,592	563,866	917,601	882,725	909,483

STATISTICAL SUMMARY, 1949-50

EMPLOYMENT, MALE AND FEMALE

SALARIES AND WAGES PAID, IN TOTAL AND PER PERSON ENGAGED

VALUE OF PRODUCTION

VALUE OF MATERIALS, POWER, FUEL, REPAIRS, etc.

VALUE OF OUTPUT

See Explanations, Appendix IV

Industries Grouping (a)	Employment			Salaries and Wages Paid		Value of Production	Value of Materials, Fuel, etc., used	Value of Output
	Males	Females	Persons	Total	Per Person Engaged			
	no.	no.	no.	£'000	£	£'000	£'000	£'000
Fuels, Lubricants, Light, Power ..	16,559	215	16,774	9,432	562	22,089	41,873	64,562
Products of Crude and Treated Non-metallic Minerals ..	32,588	1,999	34,587	15,312	442	24,955	24,066	49,021
Timber Preparation, Products of Wood, Cane, Bark, Cork, Straw ..	68,022	4,300	72,412	27,843	384	46,727	57,129	103,856
Pulp, Paper, Paperboard ..	5,541	619	6,160	3,184	517	6,581	7,152	13,733
Paper Products, Printing, Signwriting, Photographic Materials ..	34,176	14,720	48,896	20,946	428	37,442	37,259	74,701
Chemical and Associated Industries ..	22,556	7,570	30,126	13,851	460	33,225	57,774	90,999
Plastics Products ..	3,393	1,776	5,169	2,189	423	3,420	3,394	6,814
Rubber Products, Reconditioning of Tyres ..	9,772	2,610	12,382	6,185	499	9,370	16,131	25,501
Metals, Shapes, Pipes, Tubes, Castings, Forgings ..	38,819	2,495	41,314	21,831	528	45,256	97,074	143,230
Transport Equipment ..	130,305	7,113	137,418	61,843	450	85,215	55,584	140,799
Electrical and Electronic Products ..	30,519	9,720	40,239	17,308	430	26,405	28,113	54,518
Machinery, Plant, Equipment, Apparatus, Not Elsewhere Included ..	124,807	17,007	141,814	63,030	444	99,582	99,074	198,656
Food and Refrigeration, Animal Food, Beverages, Tobacco ..	92,313	31,733	124,046	52,229	421	103,076	285,440	388,516
Leathers, Woolled Skins, and Products ..	11,970	3,381	15,351	6,952	453	12,129	30,045	42,174
Textiles, Felting, Cordage ..	22,135	19,514	41,649	16,382	393	28,010	54,040	82,950
Clothing, Manchester, Napery, Footwear	41,366	99,983	141,349	44,514	315	70,666	77,790	148,456
Products of Textiles and/or Textile Wastes, Cordage, Hair, Felt, Not Elsewhere Included ..	4,667	3,308	7,975	2,864	359	5,840	11,085	16,925
Totals, Manufacturing Industries ..	689,508	228,153	917,661	385,895	421	601,488	983,923	1,645,411

- (a) See Part Three of each chapter for details of composition of each grouping.
 (b) These employment figures are taken from monthly payroll-tax returns and differ slightly from other employment figures which are supplied on annual factory returns.
 (c) The total of 6,316 shown on page 57, this study, is incorrect, the total of factories for the sub-class "Joinery" being shown as 1,126 instead of, correctly, 1,226.
 (d) Not separately published.
 (e) The September 1951 employment for "Plastics Products" is estimated. Employment for the sub-class "Plastics Moulding and Products" was not published separately, but was grouped into one total with two other sub-classes "Linoleum, Leathercloth, Oilcloth, etc." and "Bone, Horn, Ivory and Shell"; the remainder of the totalled figure is shown for the grouping "Products of Textiles and/or Wastes, etc."

Fifth Summary

NATIONAL INCOME AND EXPENDITURE, 1938-39 to 1950-51

Income

Income Payments and Other Charges	1938-39	1939-40	1940-41	1941-42	1942-43	1943-44	1944-45	1945-46	1946-47	1947-48	1948-49	1949-50	1950-51
	£m.	£m.	£m.	£m.	£m.	£m.	£m.	£m.	£m.	£m.	£m.	£m.	£m.
Wages, salaries, pay of members of forces, etc.	444	461	535	656	771	806	791	784	770	901	1,054	1,193	1,497
Company income	84	100	107	115	123	136	133	133	163	194	220	265	355
Surplus of public authority business undertakings	32	35	40	46	58	55	49	37	26	22	12	5	-1
Farm income	44	89	60	89	122	126	107	147	171	357	332	485	809
Income of unincorporated businesses, professions, etc. . .	83	82	82	76	78	78	78	98	137	175	210	240	320
Net rent and interest—													
Dwellings	64	66	68	69	67	69	69	69	69	69	71	74	78
Other	28	28	27	27	27	25	25	26	27	34	38	40	43
National Income	779	861	919	1,078	1,246	1,295	1,252	1,294	1,363	1,752	1,937	2,302	3,101
Indirect taxes less subsidies . .	90	102	111	131	149	130	125	134	172	172	218	258	290
Allowances for depreciation, etc.	52	54	58	61	64	64	66	75	82	95	112	164	202
Gross National Product	921	1,017	1,088	1,270	1,459	1,489	1,443	1,503	1,617	2,019	2,267	2,724	3,593

Expenditure

Net Expenditure on Goods and Services	1938-39	1939-40	1940-41	1941-42	1942-43	1943-44	1944-45	1945-46	1946-47	1947-48	1948-49	1949-50	1950-51
	£m.	£m.	£m.	£m.	£m.	£m.	£m.	£m.	£m.	£m.	£m.	£m.	£m.
Public authorities—													
Administration, etc.	19	21	22	24	25	26	27	32	41	50	56	64	77
Education, health, repatriation, etc.	24	24	24	25	26	28	31	38	55	68	73	89	106
New works and maintenance . .	61	57	48	38	30	31	34	44	78	100	137	206	293
War and defence	13	49	170	307	536	482	380	207	43	23	41	53	96
Overseas gifts, relief, etc. . .	—	—	—	—	—	—	—	5	39	2	14	12	2
Total	117	151	264	394	617	567	472	326	256	243	321	424	574
Financial enterprises	9	9	9	9	9	10	10	13	15	17	20	24	28
Gross private investment—													
Fixed capital equipment	124	116	91	67	46	53	72	125	191	255	333	460	583
Non-farm stocks	10	30	20	10	-20	-10	10	50	120	140	100	120	150
Farm stocks	-1	31	-16	16	16	-1	-33	19	6	69	-25	42	-14
Personal consumption	645	663	714	764	766	732	806	886	1,037	1,250	1,450	1,652	2,128
Export and other receipts for goods and services	154	186	177	167	146	163	164	176	293	429	561	638	1,028
Total Market Expenditure . . .	1,058	1,186	1,259	1,427	1,580	1,514	1,501	1,595	1,918	2,403	2,760	3,360	4,477
Less Import and other payments for goods and services	137	169	171	157	121	25	58	92	301	384	493	636	884
Gross National Expenditure . .	921	1,017	1,088	1,270	1,459	1,489	1,443	1,503	1,617	2,019	2,267	2,724	3,593

Sixth Summary

INDEX OF PRICES AND WAGES, 1936-37/1938-39 to 1951-52

Period	Retail Price Index (a)	Wholesale Price Index (b)	Export Price Index (c)	Import Price Index (d)	Average Weekly Wage Index (e)	Basic Wage (f)
1936-37 to 1938-39, Average	1,000	1,000	100	100	1,000	Shillings 79
1939-40	1,051	1,047	97	} (g)	1,065	80
1940-41	1,111	1,140	103		1,110	88
1941-42	1,176	1,242	105		1,179	90
1942-43	1,267	1,373	113		1,288	96
1943-44	1,270	1,396	117		1,329	96
1944-45	1,270	1,405	132	194	1,333	96
1945-46	1,278	1,412	151	199	1,343	97
1946-47	1,309	1,429	199	232	1,423	106
1947-48	1,393	1,588	288	269	1,565	114
1948-49	1,528	1,809	333	285	1,757	124
1949-50	1,669	2,054	386	309	1,913	135
1950-51	1,906	2,461	663	375	2,298	176
1951-52 1st Quarter ..	2,191	2,897	483	420	2,629	189
2nd Quarter	2,303	2,907	496	425	2,771	200
3rd Quarter	2,366	2,997	446	418	2,921	210
4th Quarter	2,488	3,168 (May)	444(prelim)	(Not available)	(Not available)	216

(a) Six capital cities—"C" series index compiled by Commonwealth Statistician.

(b) Basic materials and foodstuffs index compiled by Commonwealth Statistician.

(c) Includes gold. Index compiled by Commonwealth Bank, except 1951-52 quarterly levels, which were calculated by the Division of Industrial Development.

(d) Index compiled by Commonwealth Bank.

(e) Adult males, six States. (This is an index of the average weekly nominal earnings of male adult wage-earners. The actual figure at 31/12/51 was £12/8/7.)

(f) This is the weighted average of the basic wages paid to adult males in the six capital cities at the end of each period. (The basic wage is a minimum which must be paid to adult males under most Australian wage awards.) In the first quarter of 1952-53 the weighted average was £11/8/-.

(g) Not published.

Seventh Summary

VALUE OF IMPORTS AND EXPORTS, in Broad Categories, 1938-39, 1950-51, 1951-52

Class No.	Statistical Class	1938-39		1950-51		1951-52	
		Imports	Exports	Imports	Exports	Imports	Exports
		£A'000 F.O.B.	£A'000 F.O.B.	£A'000 F.O.B.	£A'000 F.O.B.	£A'000 F.O.B.	£A'000 F.O.B.
I.	Foodstuffs of Animal Origin ..	1,824	27,251	4,970	67,552	6,710	60,661
II.	Foodstuffs of Vegetable Origin ..	4,512	25,610	24,796	163,586	24,966	149,352
III.	Spirituous and Alcoholic Liquors	821	1,201	1,464	1,283	2,356	1,394
IV.	Tobacco and Preparations thereof	2,125	351	16,437	251	18,819	344
V.	Live Animals	208	217	464	640	618	774
VI.	Animal Substances, not Foodstuffs	2,214	47,329	3,789	661,972	4,855	342,552
VII.	Vegetable Substances, and Fibres	2,961	297	24,895	1,529	30,207	1,739
VIII.	Apparel, Textiles, Yarns, etc. ..	20,242	669	138,669	3,707	203,607	3,987
IX.	Oils, Fats and Waxes	9,915	713	69,819	4,104	87,444	4,292
X.	Paints and Varnishes	662	178	2,453	783	3,958	1,079
XI.	Rocks, Minerals and Hydrocarbons	1,027	2,670	8,970	12,026	5,614	21,382
XII.	Metals, Metal Manufactures and Machinery	35,653	10,058	289,839	40,284	393,277	52,266
XIII.	Rubber and Leather, and Manufactures thereof	1,926	756	30,448	2,948	35,029	2,075
XIV.	Wood and Wicker	2,371	1,109	15,795	1,707	28,022	2,369
XV.	Earthenware, Cements, China, Glass and Stoneware	2,123	219	11,120	752	19,708	1,112
XVI.	Paper, Stationery and Manufactures	7,052	493	30,595	1,149	60,019	2,119
XVII.	Sporting Materials, Toys, Fancy Goods, Jewellery and Timepieces	1,632	160	8,913	596	9,320	766
XVIII.	Optical, Surgical and Scientific Instruments	1,825	385	7,552	1,147	10,418	1,735
XIX.	Drugs, Chemicals, and Fertilizers	6,382	766	18,693	5,195	28,998	5,693
XX.	Miscellaneous	7,743	1,080	31,698	7,885	66,599	10,118
XXI.	Gold and Silver and Bronze Specie	3,537	18,963	2,492	2,700	3,673	9,805
Totals	.. .. .	116,754	140,496	743,871	981,796	1,053,217	675,614

Appendix IV:

**EXPLANATORY COMMENT ON
PRESENTATION, STATISTICS
AND TERMINOLOGY**

Explanatory Comment on Presentation, Statistics and Terminology

PRESENTATION OF THE STUDY

Grouping of Manufacturing Activities

In order properly to associate related manufacturing activities within an appropriate structure, it was found convenient to depart from the official classification used for the presentation of secondary industry statistics, and to present this study divided into a series of seventeen groups, which, although they cover the same field comprise different arrangements from those used in the sixteen statistical classes under which statistics are regularly published.

The sub-classes of industry which are shown in the principal statistical tables presented in Part Three of each group (chapter) are, however, those used by the Commonwealth Statistician in his official publications, and figures relating to production of individual products are also quoted as they appear in those publications.

Owing to the necessity for keeping confidential certain types of statistical information, figures cannot be made available by the Commonwealth Statistician in certain cases, while in other cases figures for the most recent periods may not be available. It will be appreciated, therefore, that where figures are not given in the tables it is because they are not yet available, or cannot be made available for publication.

Establishments and Manufacturers

Where figures are given for the number of establishments in a statistical sub-class, it should be borne in mind that these are establishments which carry out the industrial activity covered by that sub-class as the largest or most important part of their manufacturing undertaking. However, the same activity is frequently carried out as a minor or less important part of the manufacturing undertaking of establishments which are classified under a different industrial sub-class, and figures for goods produced will cover the activities of the latter categories as well as the former. It will be appreciated, therefore, that

the number of manufacturers engaged in the production of a certain product or range of products covered statistically by a particular sub-class is, in many cases, greater than the number of establishments quoted in statistical tables.

Primary, Secondary and Tertiary Industry

This study is concerned with secondary industry in Australia and treats the other groups only incidentally. It is, however, impossible to define the exact scope of the term "secondary industry", as covered by the study. Perhaps the most logical distinction which can be drawn is to postulate that primary industry is the winning of any substance from nature, and that secondary industry is the carrying out of any process upon any substance, as it is won from nature, which produces any change in the constitution, form, shape or volume of such a substance. Tertiary industry comprises all the rest of human bread-winning activity which does not involve the production of any physical thing.

It has always been found, however, in practice that no such definitions can be strictly followed and there is always a border zone in which classification is difficult or impossible and which in any given case depends upon accepted practices. For example, the sun-drying of fruit is, according to the strict definition given above, a secondary industry; but as in Australia it is practically always carried out on the farm where the fruit is grown, sun-dried fruit is generally accepted as a primary product. Similarly stone crushing carried out in a quarry is considered to be part of the activity of quarrying (unless it constitutes a major part of the activity of the undertaking which carries it out, the quarrying merely being subsidiary).

In this study, an attempt has been made to follow as nearly as practicable the definition of secondary industry given above, and where this has not been possible, every effort has been made to make it clear in the text just what activities are covered.

STATISTICS AND DEFINITIONS OF TERMS

Statistical Sources

The sources of statistics used throughout this study, apart from original estimates of statistics compiled by the Bureau of Mineral Resources, Geology and Geophysics, and the Department of Shipping and Transport, are the various publications of the Commonwealth Bureau of Census and Statistics, including the following—

Overseas Trade Bulletin (yearly to 1950-51)
Overseas Trade Statistics—Imports Cleared for Home Consumption ("Customs Clearances") (yearly to 1950-51)
Production Bulletin, Part I: Secondary Industries (yearly to 1948-49)
Manufacturing Industries Bulletins for 43 Groups of Industries (yearly to 1949-50)
A Summary of Principal Statistics of Factories: Australia, 1949-50, Vol. 1, No. 2.

Transport and Communication Bulletin (yearly to 1948-49)
Quarterly Summary of Australian Statistics (to March, 1952)
Quarterly Bulletin of Building Statistics (to March, 1952)
Monthly Review of Business Statistics (to May, 1952)
Monthly Review of Production Statistics (to June, 1952)
Monthly Review of Overseas Trade Statistics (to June, 1952)
Monthly Review of Employment Statistics (to September, 1951)

Unless otherwise indicated, all statistics used in the study, excluding estimates of various kinds throughout the text, are taken from the publications of the Bureau of Census and Statistics.

DEFINITIONS OF STATISTICAL AND OTHER TERMS

Official Definitions

As a general rule the terms used to describe statistical information are used with the same meaning as that given to them in the various publications of the Bureau of Census and Statistics, and should be read subject to the Commonwealth Statistician's definitions.

"Factory": An industrial establishment in which four or more persons are employed or in which power other than hand power is used if less than four persons are employed.

"Value of Output": The value of goods manufactured or work done. It is based generally on the selling value at the factory, exclusive of all delivery costs and charges and of excise duty (if any).

"Value of Production": The value added to materials by the processes of manufacture. It is calculated by deducting from the value of output the value of materials and fuel used (as defined below). In this study, the Commonwealth Statistician's "Value of Production" statistics have been used only in the "Statistical Summary, 1949-50" table included in Part Three of each chapter and in Appendix III.

"Value of Materials and Fuel Used": This includes the value of power, fuel, light, lubricants, water, tools replaced, repairs to plant, containers, packing, etc., as well as all other materials used. In accordance with this definition, deduction is made from the value of output, of the cost of raw material, containers, power, fuel, light, lubricants, water, tools replaced, and repairs to plant. The value of production as given in "Statistical Summary, 1949-50" tables of this study is, therefore, the remainder after deducting the value of these items from the value of output.

"Employees": All persons employed in the manufacturing activities of a factory. Employment figures, therefore, exclude all those engaged in selling and distribution, such as salesmen, travellers, collectors, carters engaged solely on outward delivery of manufactured goods and retailing storemen. They include proprietors who work in their own businesses as well as out-workers. Several sets of employment statistics are available, including some calculated on average employment over the whole year, and some calculated on employment in the month of June. Various figures showing employment in the months of June, 1950, and September, 1951, are also quoted, but these are provisional and subject to later revision. All these have been used in the tables contained in this survey, and it will, of course, be appreciated that the figures are, therefore, different.

"Value of Imports": An amendment to the Customs Act 1901-1936 which has operated from 15th November, 1947, provides for the value of goods imported into Australia to be recorded in Australian currency, and this value represents the amount on which duty is payable or would be payable if the duty were ad valorem. Section 154 (1) of the Customs Act 1901-1948 provides that "when any duty is imposed according to value, the value for duty shall be the sum of the following—

- "(a) (i) the actual money price paid or to be paid for the goods by the Australian importer plus any special deduction; or

- (ii) the current domestic value of the goods, whichever is the higher;

- "(b) all charges payable or ordinarily payable for placing the goods free on board at the port of export".

"Current domestic value" is defined as "the amount for which the seller of the goods to the purchaser in Australia is selling or would be prepared to sell for cash, at the date of exportation of these goods, the same quantity of identically similar goods to any and every purchaser in the country of export for consumption in that country".

In all tables the value is recorded in Australian currency.

"Value of Exports": The value of goods exported (including cost of containers) is recorded in Australian currency and the f.o.b. values have been determined as from 1st July, 1937, as follows—

Goods sold to overseas buyers before export—the f.o.b. equivalent of the price at which the goods were sold (e.g., as regards wool, the actual price paid by the overseas buyer plus the cost of all services incurred by him in placing the wool on board ship). Goods shipped on consignment—the Australian f.o.b. equivalent of the current price offering for similar goods of Australian origin in the principal markets of the country to which the goods were despatched for sale (as regards wool, the f.o.b. equivalent of current price ruling in Australia will normally provide a sufficient approximation to the f.o.b. equivalent of the price ultimately received).

Figures given for exports in this study are, unless otherwise stated, figures for exports of Australian produce only. Re-exports are not included.

Other Definitions

There are some terms used in relation to statistical tables quoted in this study which are in common use by Australian statisticians, but which are not specifically defined in publications—

"Establishment": Although not specifically defined, where the word "establishment" is used in a statistical table and in text, it may be taken to mean a "factory" (as defined above), of the particular category described in the table or text from which the quotation is taken, at a single physical location.

"Machinery, Plant, Equipment, Apparatus": Four terms which are not defined for the purposes of published statistics, but which appear in this study, both in the text and in statistical tables, are "Plant", "Machinery", "Equipment" and "Apparatus". As explained in the introductory note to Part One of Chapter 12, "Machinery, Plant, Equipment, Apparatus", these terms have been used to cover a very wide range of products. For the purposes of statistical tabulation, however, they are used specifically in respect of certain sub-classes of industry. This will be evident where statistics in respect of any of these sub-classes appear in the study. For the wider purposes of description of structure and capacity, and in particular for the purposes of the chapter entitled "Machinery, Plant, Equipment, Apparatus" just mentioned, the following broad definitions have been adopted—

Plant: "Plant" includes all categories of physical assets used by a manufacturer in his manufacturing establishment for the purposes of production. Such categories of machinery, equipment and apparatus as are used in this way are included in the embracing category of "Plant." The term has been applied, by analogy, to some categories used by rural and other industries.

Machinery: "Machine" includes all devices consisting of two or more parts, one at least of which moves always in the same relationship to the others, and by which energy is utilised to perform work. "Machinery" includes machines together with their component parts.

Equipment: "Equipment" includes all those physical things which are specifically designed to carry out a particular function. As such it overlaps the other three categories of Plant, Machinery and Apparatus, but none of those three are completely contained within the definition of "Equipment".

Apparatus: "Apparatus" includes any series of physical things arranged so as to be able to carry out a particular task. Although it does not, therefore, completely exclude the category of machinery it does specifically include the manufacturer's assets which do not fall within the definition of "Machinery" as given above.

The law relating to the formation and regulation of companies comes under the jurisdiction of each individual State and therefore

varies slightly between States, although the fundamental principles are similar. Limited liability companies fall into two classes—

Public Companies are usually large organisations; the minimum number of persons which may comprise a public company is five in Victoria, South Australia and Western Australia and seven in other States—the total number is limited only by the amount of share capital. All public companies must use the word "Limited" (or a contraction thereof) as the last word in the name of the company.

"Proprietary" or "Private" Companies are usually formed to secure the advantages of limited liability to the members of a smaller organisation—e.g., a family business, partnership, subsidiary company, etc. The minimum number of persons who may form a proprietary or private company is two and the maximum number permitted to be shareholders of the company is 50 (except in Western Australia, where the maximum is 21). A proprietary company must include, in the name of the company, the word "Proprietary" (usually contracted to "Pty.") penultimate to the word "Limited". In South Australia, in addition to a public company and a proprietary company, a "private" company may be formed (similar in effect to a proprietary company), the name of which need not contain the word "Private" (or "Pty."). (This may, in some instances, lead to confusion as, for example, "Smith & Co. Ltd." may be either a public or a private company.) Most companies which would in other States be proprietary companies are in South Australia "private" companies.

TERMINOLOGY OF PROCESSES AND PRODUCTS

Terms used in this study to describe industries, products or processes are as a general rule those commonly used in Australian industry for the purpose. Not infrequently, these terms differ from those used in the same context in other countries. In the absence of

any accepted standard terminological references it has been impossible to achieve general uniformity, and the possibility of variations in trade terminology should always be kept in mind.

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